JUNE 19, 1937

ELECTRICAL WORLD

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Coming Features

Insulator Dynamics Benefit by Test

Precision measurements perfected to determine the dynamic characteristics of suspension insulators under service stresses will be fully discussed in an article soon to appear.

A.I.E.E. Summer Convention Report

A full report of the technical discussion at the summer convention of the A.I.E.E., to be held in Milwaukee, June 21 to 25, will appear in ELECTRICAL WORLD of July 3.

Motor Requirements for Plant Changeover

Factors to be considered in planning an industrial plant changeover such as machine loading, grouping, selection of motors and control and arrangement of drive will be correlated in a coming article.

On the Cover

A view along the length of the 110-ft. long Bethanizing cell at the Cambria plant of the Bethlehem Steel Company. Wires to be electrogalvanized are the cathodes of this huge cell, in which zinc is electrodeposited on steel wire.

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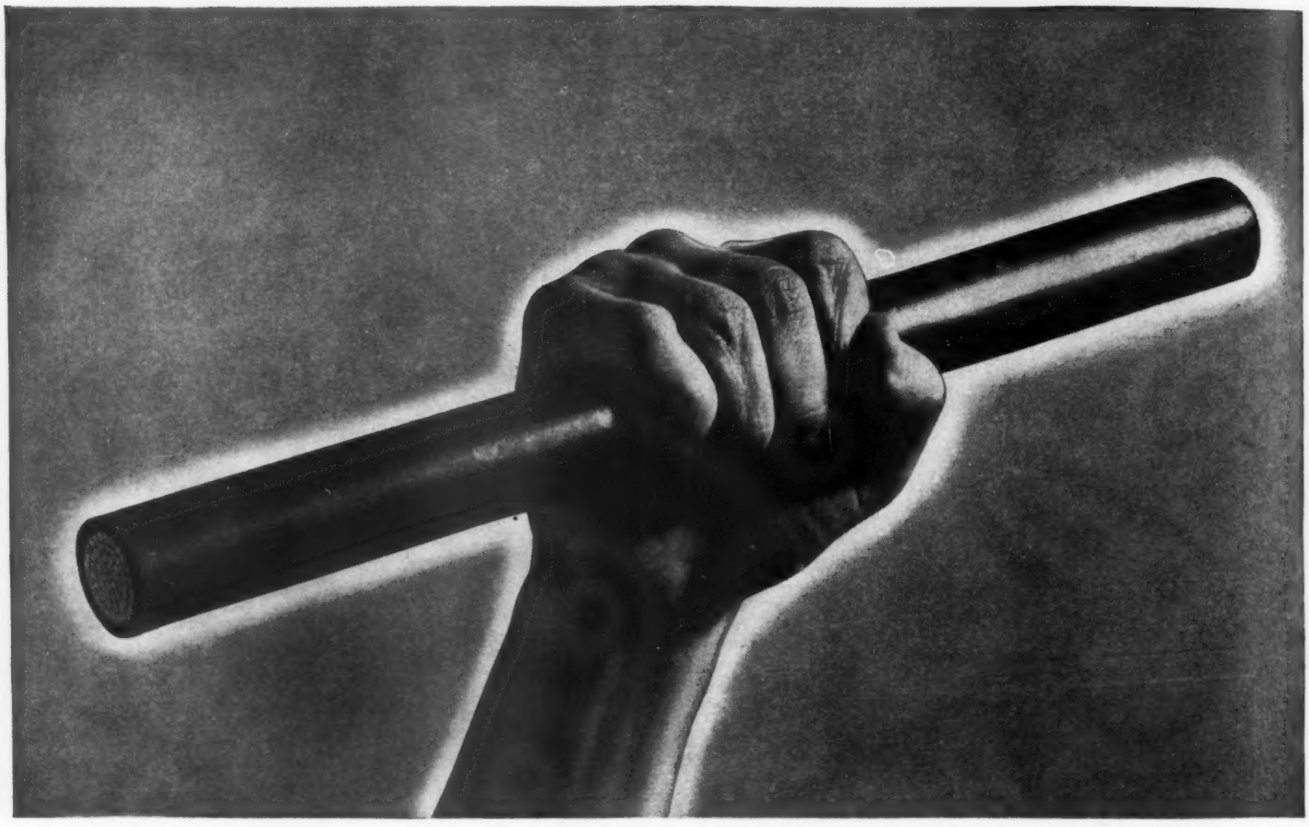

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OKONITE QUALITY CANNOT BE WRITTEN INTO A SPECIFICATION

ELECTRICAL WORLD

JUNE 19, 1937

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Labor Must Be Made Responsible

Twice within the past few weeks the public of certain Michigan communities has been denied electric service by organized labor. Twice has a small organized group tried to enforce its demands upon the management of a public utility company without the slightest regard for the inconvenience, loss and suffering of the public.

Strikes which prevent utilities from serving their communities are not only strikes against management but, to a much greater degree, are strikes against the public. Electric service has become such an important element of our everyday life that to interrupt it means loss of employment, loss of business and inability to perform normal household duties. The public that suffers these losses and inconveniences is an innocent bystander. Why should it be made to suffer in order that a small number of men might try to force on the utility management their demands?

While denying service to industry, trade and the home, the striking employees were careful to preserve a semblance of regard for the public interest by permitting the supply of electric energy to hospitals, sanitary operations, fire alarm and other municipal operations. But what of the sick at home and the babies, dependent upon electric refrigeration and perhaps electric cooking?

Thousands of men were thrown out of work while the power was off. Their aggregate loss in wages was many times more than the gain which the strikers were demanding would total in a year. Businesses were forced to shut down because there was no power, no lights, no elevator service. The public was prevented from making purchases because the transportation system was interrupted. Farmers dependent on rural service were forced to suspend essential operations and take large losses. Must the public be forced to accept such losses?

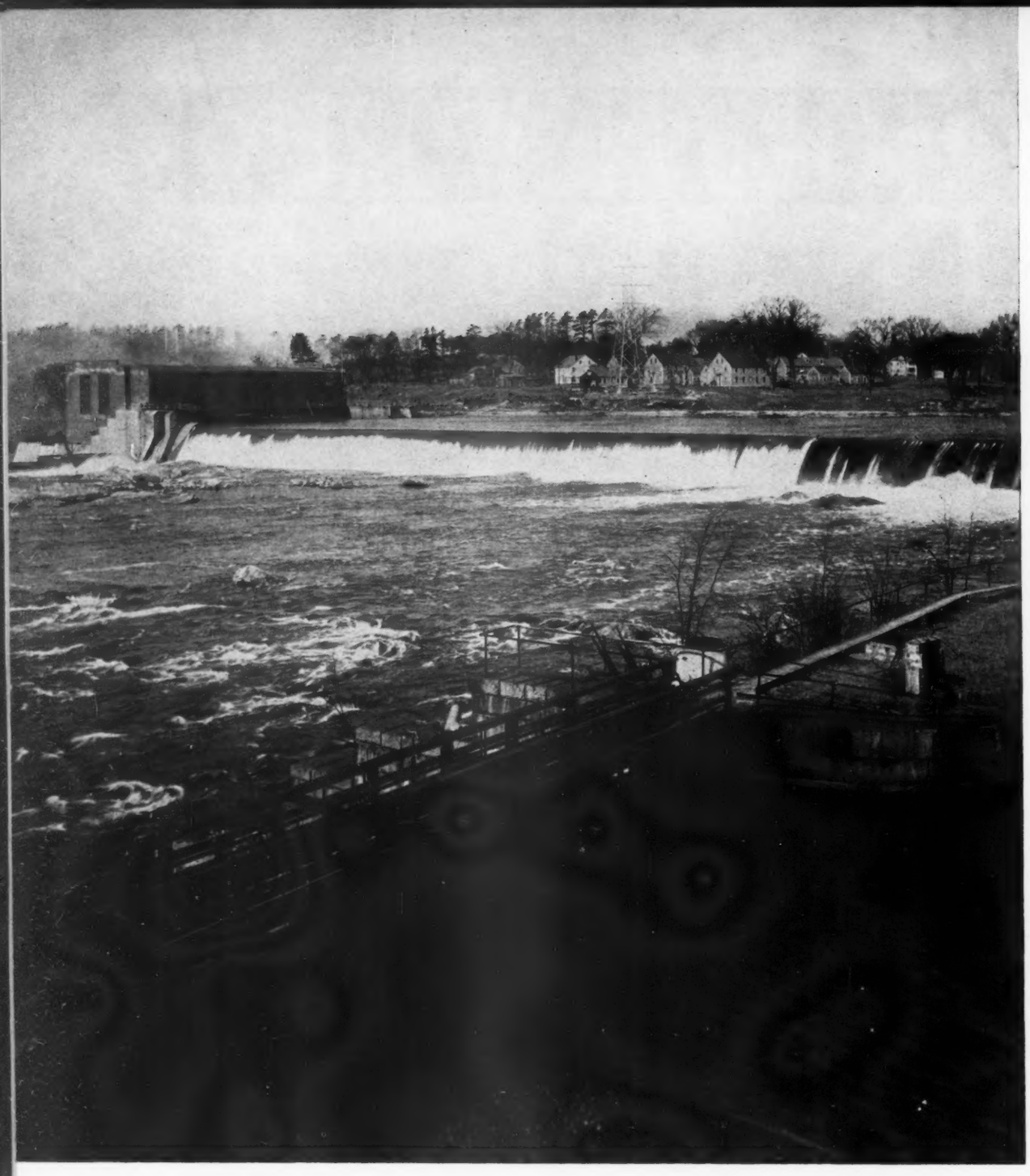
A fundamental in electric utility policy has always been to make every effort, sometimes beyond the bounds of what might at the time seem reasonable, to maintain uninterrupted service. If in the past utilities have seemed unfavorable to the unionization of employees, it has been because of the fear of just such disruption of service as has occurred in the Saginaw Valley.

While the right of labor to bargain collectively through organization must be recognized, the public also has the right to protection against loss of employment, loss of business and inability to engage in its normal social, educational and domestic activities. That right must be protected by law.

Strikes against electric utilities transcend the ordinary struggles between capital and labor. No matter what the outcome might be, the public suffers a loss that can never be regained. This loss might be avoided if organized labor were made responsible for its actions. Laws against strikes on utility operations are of little avail unless the city and state officials are willing to enforce them.

While labor might complain that utility management is unreasonable and unwilling to bargain, we have only to look at the record of the industry in maintaining uninterrupted service to feel that management will do everything within reason to uphold that record. However, utility management, like any other business, cannot accede to every demand that labor might care to make. It is willing to bargain collectively with its employees, but it should not be placed in a position where it must accept the dictates of labor or be forced to deny essential service to the public.

Organized labor is rapidly growing in power, but with that new power there must go new responsibilities. Unless labor can enforce discipline within its ranks, can make its agreements binding upon its members, and can have the same regard for the public interest as does management, then we must have laws in this country that will regulate organized labor just as other businesses that affect the public interest are regulated.



ITS SALE TRANSFORMED A CITY

One of the most famous hydro-electric plants in New England industrial history—the 16,000-kw. Merrimac River station bought from the Amoskeag Manufacturing Company of Manchester by the Public Service Company of New Hampshire. The utility paid $2,225,000 for the installation with water rights in connection with the organization of Amoskeag Industries, Inc., successor of the world's largest cotton mill. Purchase was a major factor in preventing liquidation of the mills under auctioneer's hammer. It paved the way for a co-operative citizenry to develop new industries on the 120-year-old property with an influx of new concerns, rearrangement of power facilities and transformation of the Granite State's largest city from a community of dark apprehension to a metropolis of realized hope.

System Outlay Saved Justifies Capacitors

Compensating Inductive Reactive Creates Generator, Transformer and Circuit Capacity by Relieving Them of Wasteful Heating

That correcting the system power factor at the load centers will release system capacity was shown by F. S. Douglas in ELECTRICAL WORLD, *December 19, 1936. Here will be considered the release obtained for equipment whose rating is limited by heating effects. It is demonstrated that power-factor correction more than justifies its case, and the limit to which it can be carried is largely fixed by system operating restraints rather than by mere cost outlays.*

By A. C. MONTIETH
Central Station Engineer
Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa.

ALL THE equipment from the point of power-factor correction back to the source is affected when capacitors are applied. This necessitates that the costs back to the source be investigated when surveying the feasibility of installing corrective equipment. Four different authentic sources of information have been tapped for the average cost data presented in Fig. 1, which shows that a large percentage of the total system costs is invested in equipment, the rating of which is determined by heating.

Generator outputs are limited by heating, or, if operated at lower than rated power factor, by the field. Improving the power factor up to the generator rating releases generator capacity faster than would be indicated by consideration of load current, since the field current decreases faster than the load current. Substation investment represents a large proportion of the system cost and the load that can be carried is largely limited by the heating of the transformers. Although in some cases transmission and feeder capacity is indicated by voltage drop, nevertheless heating is often a large factor in determining the load that can be carried, especially if the power factor is improved.

Some of the limiting factors when the problem is approached from a heating viewpoint are shown in Fig. 2. The broken curves below the unity base line show the power in unit kw. that can be carried for a given load power factor based on having an initial system capacity of 1 kva. These curves also show the increase in kw. that can be carried as improvement is made in the power factor by adding leading reactive power. The curves are based on increasing the load at the original power factor and also on keeping the resultant kva. constant; this will result in constant losses.

Consider the example of a feeder or piece of equipment rated at 1,000 kva., the rating of which is limited by heating. Assuming that the load is at 65 per cent power factor, by referring to the curves it is seen that the kilowatts carried are 0.65 × 1,000 or 650 kw. Adding 0.6 × 1,000 or 600 kva. in leading reactive power, the same equipment can carry 0.895 × 1,000 or 895 kw. at the original 65 per cent power factor.

Cheaper to correct than to add

The solid curves above the base line show the kva. corresponding to the total load that can be carried at the original power factor.

In the case cited the addition of 600 kva. of leading reactive power allows a load of 1.38 × 1,000 or 1,380 kva. This can be carried with the original investment in 1,000 kva. equipment capacity and the addition of a capacitor of 600 kva. rating. If the system has an orignal cost of $10 per kva. and it costs $10 per kva. to add leading reactive power, then the original system cost will be $10,000 and the capacitor cost will be $6,000, or a total investment of $16,000 with no increase in losses. If it were possible to add small increments of system at the original cost, then the cost of building the system without a capacitor would be 1,380 × 10 or $13,800 with some slight increase in losses. Thus it is seen that for this low cost of system it

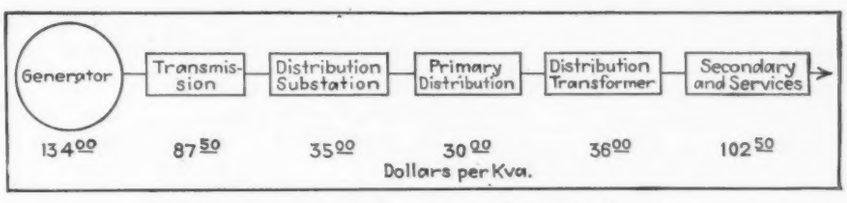
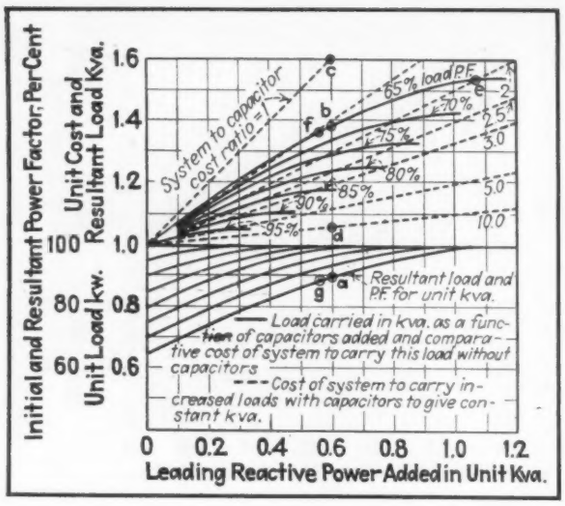


Fig. 1—Average cost of component parts of system



Example: Original system 1 kva., original load 0.65 kw. Add 0.60 condenser kva. (a) Resultant load 0.895 kw. or 89.5 per cent power factor. (b) Load now carried 1.38 kva. at 65 per cent power factor. System cost $10 per kva.=$13.80 for system built without condenser capacity. (c) A+$10 per kva. system cost and $10 per kva. condenser cost or "ratio 1." Resultant cost using corrective measures 1.6×10=$16. At $100 system cost (b) =$138,000, (d) =$106,000. (e) Point where total investment is same for building new system at same unit cost as compared to original system and adding condenser capacity or corresponds to point 2, Fig. 3.

Fig. 2—Comparative loads, power factors and costs as a function of condenser capacity

is more economical to add system capacity than to increase the rating of the system with a capacitor.

Considering the same example and an original investment of $100 per kva. in equipment whose rating is limited by heating, the original system would cost $100,000, and adding 600 kva. leading reactive power at $10 per kva. results in a total investment of $106,000. If the new load had been carried by increasing the original system the cost would be $138,000. Correcting power factor shows considerable economy in this case.

A study of the solid curves above the unity base line indicates that if the system cost is considered on a unit basis these curves also become cost curves where the original system capacity is increased as the load increases. Likewise, the cost of the system considering the initial investment plus the cost of a capacitor is a straight line, the slope of which depends on the cost of system as compared to the cost of the capacitor.

For example, for $10 capacitor cost and $10 system cost the "ratio one" curve is used and the total investment is $1.6 \times 10 \times 1{,}000$ or $16,000 for the example cited above. Likewise, following the original system plan the cost is $1.38 \times 10 \times 1{,}000$ or $13,800. The other example can also be taken directly from the curves.

This allows a direct comparison of the cost of the two methods of increasing system capacity and shows readily the economic point of balance on a first cost basis. The fact should not be overlooked that in considering a capacitor the losses are kept practically constant, while increasing the system along the original lines will increase the losses with increased load. A comparison of the curves shows that for $10 cost of condenser capacity and $10 system capacity cost it is cheaper to increase the system capacity than to release system capacity by adding a capacitor to the system. The "ratio one" curve is consistently above the cost of the original system curve for all loads down to 65 per cent power factor. The same is true for the ratio of 1.5. It is seen that for a ratio of 2 the total investment is a standoff for system loads at 80 per cent power factor, but shows some economy for systems with lower power factor loads.

Considering the other extreme, it is seen that for "ratio 10" it is cheaper even up to approximately 97 per cent system power factor to release system capacity by adding leading reactive power. When leading reactive power is added the new operating power factor is obtained from the broken line curves below the unity base line. For example, adding 0.6 kva. of leading reactive power on a feeder rated at one kva., carrying a load at 65 per cent power factor, results in a new power factor of 89.5 per cent.

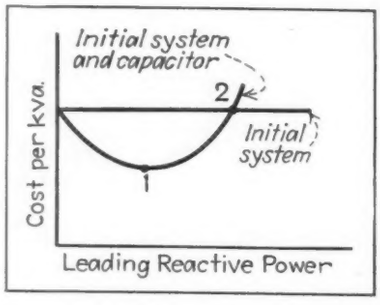


Fig. 3—Typical comparative unit cost as a function of leading reactive power

Point 1 corresponds to (h), Fig. 4. Point 2 corresponds to (c), Fig. 2.

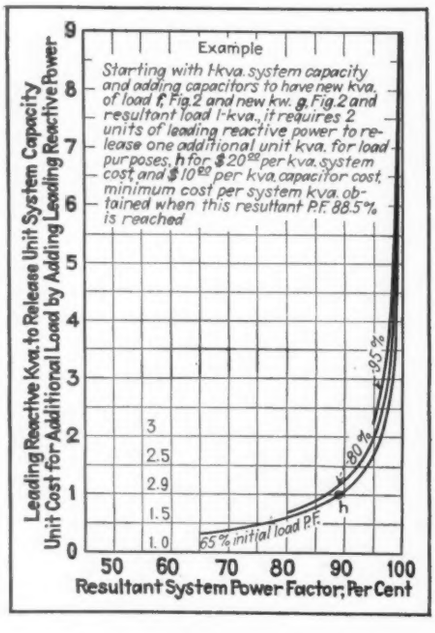

Example
Starting with 1-kva. system capacity and adding capacitors to have new kva. of load f, Fig. 2 and new kw. g, Fig. 2 and resultant load 1-kva., it requires 2 units of leading reactive power to release one additional unit kva. for load purposes, h for $.20 per kva. system cost and $10 per kva. capacitor cost, minimum cost per system kva. obtained when this resultant P.F. 88.5% is reached
Leading Reactive Kva. to Release Unit System Capacity
Unit Cost for Additional Load by Adding Leading Reactive Power
9
8
7
6
5
4
3
2
1
0
3
2.5
2.9
1.5
1.0
65% initial load P.F.
80%
85%
h
50
60
70
80
90
100
Resultant System Power Factor; Per Cent

Fig. 4—Correction necessary for release of our additional kva. system capacity

System cost to condenser cost in ratio 5/1

Choice between primary and secondary

The question has been raised as to whether capacitors should be installed on the low-tension side or high-tension side of the distribution transformer. When it is considered that the capacitors installed on the low side would cost approximately $20 per kva., as compared to approximately $10 per kva. on the primary side, or a difference of $10 per kva., it is readily seen that for an average cost of $15 per kva. for distribution transformers, applying capacitors to the low side is a standoff in cost for 65 per cent power factor load and uneconomical for all higher operating power factors, as illustrated by the 1.5 ratio curve.

Reviewing the average system costs given above it will be noticed that when considered from a heating viewpoint a capacitor can be added to improve the load power factor to practically unity because there is at least $100 per kva. invested in equipment, the rating of which is determined by heating. When the load power factor is below the rated power factor of the generators this investment will be considerably higher, often amounting to $200 to $250 per kva. of system. For a ratio of 10 or higher considerable

can be gained (Fig. 2) by power-factor correction.

Where the solid and dotted curves of Fig. 2 cross, indicate where the initial investment by either method is the same (illustrated by point 2, Fig. 3). However, the minimum cost per kva. (point 1, Fig. 3) is reached at a lower point on the curve. It is evident that beyond a certain point comparatively more leading reactive power is required to release a kva. in carrying capacity, or, in other words, there is a diminishing return the more leading reactive power is added, and finally the cost of adding enough leading reactive power to release a unit in carrying capacity exceeds the original cost per kva. of the system.

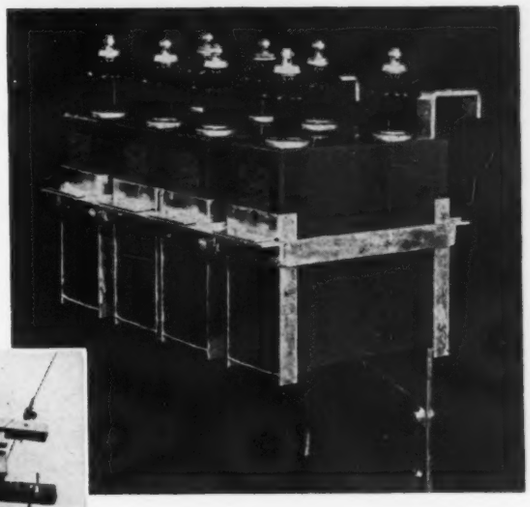
Leading reactive power in kva. necessary to release an additional kva. system capacity when considering a certain load power factor and correcting to a new power factor is indicated in Fig. 4.

For example, starting at 65 per cent power factor it takes 1.3 units of leading reactive power to release 1 unit kva. of system capacity. At 90 per cent power factor it takes 2.1 units to release 1 unit kva. of system capacity and at 98 per cent power factor it takes 3.75 units of leading reactive power to release 1 kva. of system capacity.

The point at which the cost of a capacitor is equal to the cost of additional system is indicated where the dotted and solid curves cross. Considering a load power factor of 65 per cent and unity ratio of system cost to condenser cost, it is apparent that it is never economical to use a capacitor to release system capacity. At 1.5 ratio the cost of adding a capacitor balances the cost of adding system at 75 per cent power factor (illustrated by point 1, Fig. 3). Or, in other words, the cost per kva. released by adding a capacitor is less than original system cost up to 75 per cent power factor. Beyond this the cost of releasing capacity by adding a capacitor is higher than continuing building the original system.

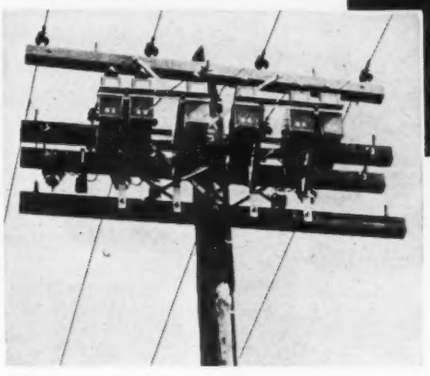
This limiting power factor increases, the higher the cost of system considered, until at "ratio 10" the cost is a minimum at 99 per cent power factor. Again, for a load of 80 per cent power factor the minimum system cost per kva. for "ratio 3" is at 95 per cent power factor. Although the minimum cost per kva. is at a lower final power factor than where the cost is equal for releasing system capacity by adding leading reactive power as compared to building system at the original cost, it will no doubt be economical to go beyond the minimum (point 1, Fig. 3) because capacitors can be added beyond this point in small increments and will defer adding further system capacity which, of necessity, must be added in steps rather than in small increments.

60-kva. capacitors in rack for pole mounting



Simplified pole mounting of unit capacitors developed for ease in placing near utilization point

Assembly shows method for mounting 90 kva.



Problem of uniform reactive

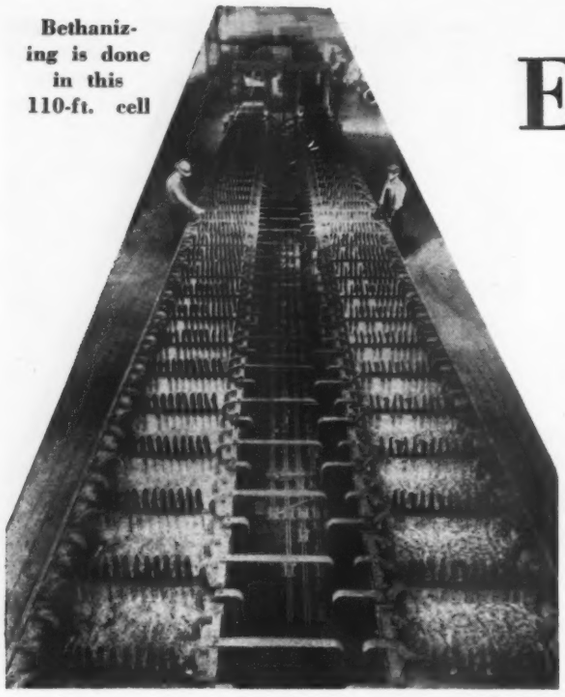
Tests on some systems indicate that the reactive kva. of the load remains practically constant for different times of day. This type of load simplifies the decision on the limits of leading reactive power to add. Complete correction would result in unity power factor load at all times of day. With the higher increment cost of equipment limited by heating, it is economical to consider complete correction, while with lower cost complete correction cannot be justified. The actual solution on a system will be more complicated than this ideal and the general analysis presented should be taken to indicate in general the economies that can be effected when heating is the limit of the equipment. The actual solution will depend on the system being considered, the type of load, and other factors. For some parts of the system an analysis from a voltage drop point of view * will indicate in some cases a greater release of system capacity per kva. of capacitors added than will be indicated when approaching the problem from a heating point of view. If, however, the cost per kva. of this capacity released from a voltage point of view is small compared to the cost of all the equipment released when approaching the problem from a heating point of view the approach giving the lowest system cost should be considered.

Use of a capacitor will not eliminate the necessity for voltage-regulating equipment. When synchronous condensers are used the adjustment of the field will give voltage control. It is only economical to use synchronous condensers at the larger load centers. Correcting power factor at the distribution load centers releases further system capacity, reduces system losses and gives more uniform voltage along the feeder. When the cost of distribution is large it will be economical to use the smaller units of capacitors mounted on poles near the utilization point, as shown in the two illustrations on this page.

Bearing on machine stability

Voltage regulation will have to be accomplished by the use of induction regulators or step type regulators on the feeders or by the use of tap-changing-under-load equipment on the main transformer banks. Where power is transmitted a considerable distance stability may dictate the economic limit to which power-factor correction can be carried. Correcting the load power factor will result in lower generator field currents and will result in less stable machines.

* Shunt Capacitors on Distribution Circuits by G. P. Gamble and F. M. Starr, General Electric Review, October 1936.



Bethanizing is done in this 110-ft. cell

Electrogalvanized

Ductility, Bond and Toughness Obtained With High Purity Coating

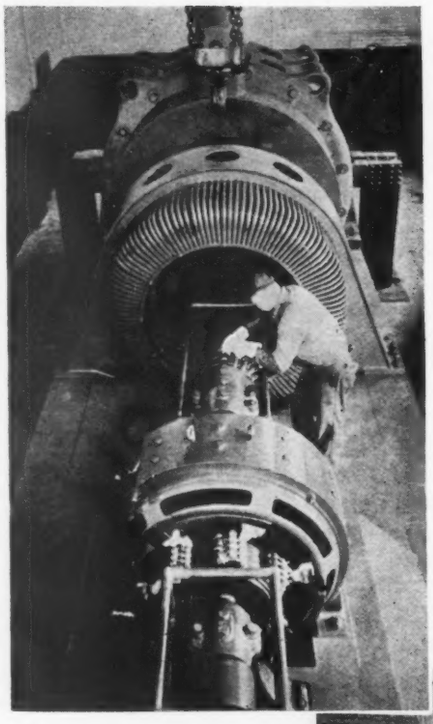
Culminating eight years of electrochemical and electrometallurgical research, Bethlehem Steel Company has created a protected wire that can combat corrosion depreciation. There are many technical innovations in the production process. Further, it proves the frequent assertion that industry has hardly begun to use amperes and watts. It proves also that electricity is more and more frequently the means by which a good product is made a lot better in one sudden step.

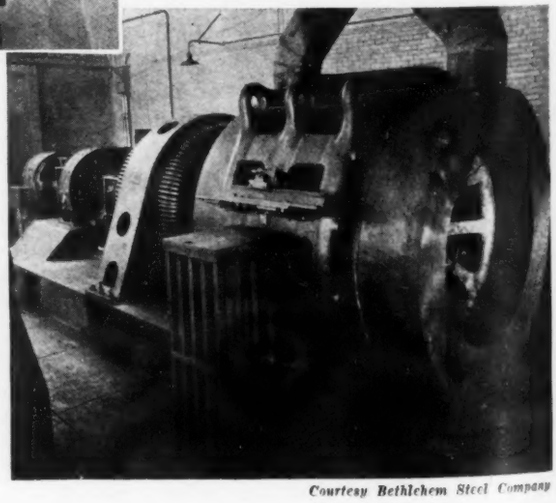
ELECTROPLATING zinc onto steel wire in the tonnage that the prevailing hot-dip galvanizing reaches every year in fence wire, suspension strand and guy wires would seem an impracticable and uneconomical alternative to most people. But Bethlehem Steel had faith. U. C. Tainton, with the co-operation of the Bethlehem metallurgical and engineering staffs, stuck to it by pioneering in the development of cleansing and plating baths, until the process became commercially successful. Now Bethlehem is hustling wire through the tanks as fast as or even faster than it goes through the envious hot-dip equipment in an adjacent aisle.

Best quality charcoal ("double galvanized") wire, except for conditions of severe service, has given a good account of itself in the electrical industry. But it has not been practicable to apply to the wire by the older method the heavier coating of zinc necessary for the more severe service requirements. Nor does the hot-dip coating have the ductility or bond to steel desirable in many applications. Further, some grades of steel, as needed for the service, do not well lend themselves to hot dip galvanizing.

It was for these reasons that the electrogalvanizing process was perfected. The resulting physical properties of the coated steel are entirely different from any of the zinc coatings so far produced by either the hot-dip galvanizing process or the conventional zinc electroplating process. The mechanical bond is so firm and the ductility of the zinc so high that bending or forming or drawing-down does not impair the protective value of the coating. Any degree of thickness of coating can be provided. Regular Grades B and C are given, respectively, two and three times the ounces of zinc per square foot of Grade A, which is the same as prescribed for "charcoal-wiped" or "double" hot-dip galvanized wire. Hot-dip galvanized coatings are essentially a cast deposit with the characteristic brittleness and flakiness of a casting.

In the new process the zinc is applied to the surface of the wire by electrodeposition from a bath of purified zinc sulphate solution circulated through the electrolytic cells. There is no metallic zinc in the system except that which is deposited out of the solu-





Homopolar generator is supply for electrodeposition current

Below—Machine rated 12 volts and 40,000 amp. Note ventilation shields and ducts and also the inclosure of the heavy bus feed which passes under the floor to the bus run longitudinally between the two electrodeposition baths. Above — Synchronous motor drives the homopolar generator, the exciter for all auxiliaries and two pairs of separate units for supply to each of the anodic and caustic cleaning baths that precede the deposition cells. Shown before inclosures and ventilation were installed on generator.

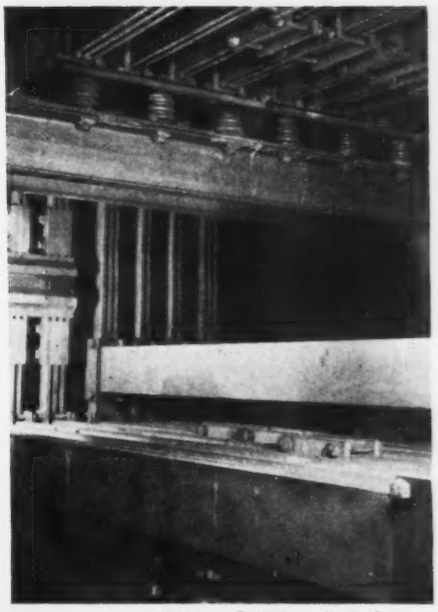
Courtesy Bethlehem Steel Company

Wire Gives Corrosion Defiance

By W. C. FRANK . . . W. E. MILLER
Chief Engineer Superintendent Maintenance Dept.
Cambria Plant, Bethlehem Steel Company, Johnstown, Pa.

tion as virgin metal, spectroscopically pure, creating a tough, ductile and tenacious coating. This is in contrast to the process of transferring zinc from a soluble anode through an electrolyte onto the surfaee of the wire. Current densities are much higher than in previous electroplated galvanizing.

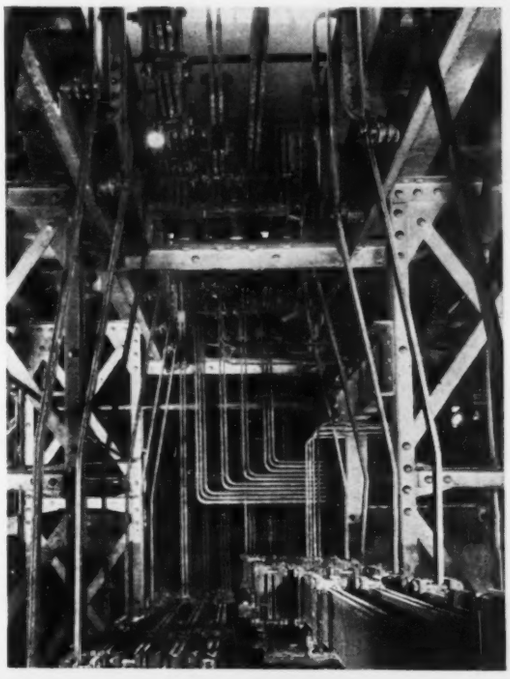
It should be recognized that zinc does not owe its protective properties to a non-corrodable attribute. Atmospheric attack on zinc does "corrode" the zinc, but, by virtue of the very high purity of this new zinc coating, the resulting products are in the main insoluble in water and thus check the progress after formation of a very thin film of carbonate or oxide. More important is the fact that zinc is electronegative to iron and thus monopolizes response to the attack as long as there is any zinc present. Purity of the zinc, especially freedom from iron contamination in the zinc coating (hard to avert in the hot-dip process) is conducive to minimum of galvanic



Courtesy Bethlehem Steel Company

Busbars under homopolar generator

Ten copper busbars 6 x ½ in. from each of the two positive and two negative terminals merge to form 20-ft. run to cell bus. Note 40,000-amp. ammeter shunt on vertical bars. The 40 6 x ½-in. bars extend to the middle of the cells, whence the assembly tapers toward each end with risers at 3-ft. intervals. Approximately 40 tons of copper was used to complete the bus system.



Distribution and short-circuiting buses with connections to short-circuiting switches on either side

The offsets are taps to anodes and cathodes. All bus joints are tinned, subjected to heavy clamping pressure and well ventilated by spacing and vertical arrangement.

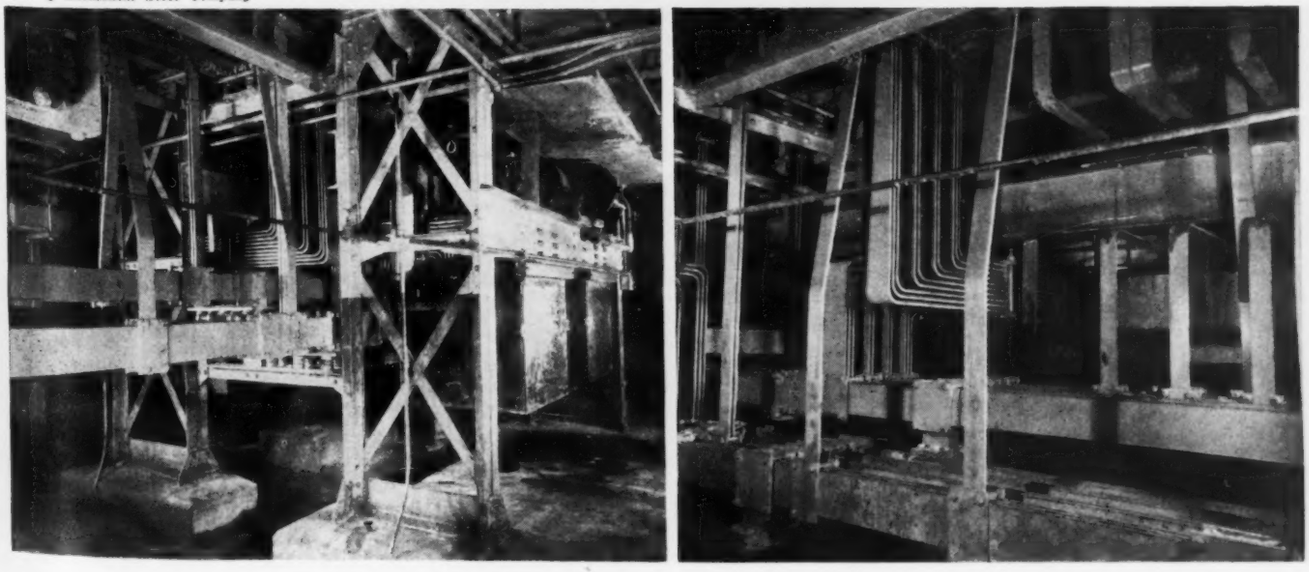
Courtesy Bethlehem Steel Company

Switches provided to short circuit either cell

Left—Switches are oil-inclosed because of corrosive atmosphere. Contactors make final break after main contacts part. Operated under load by 7½-hp. motor working against spring.

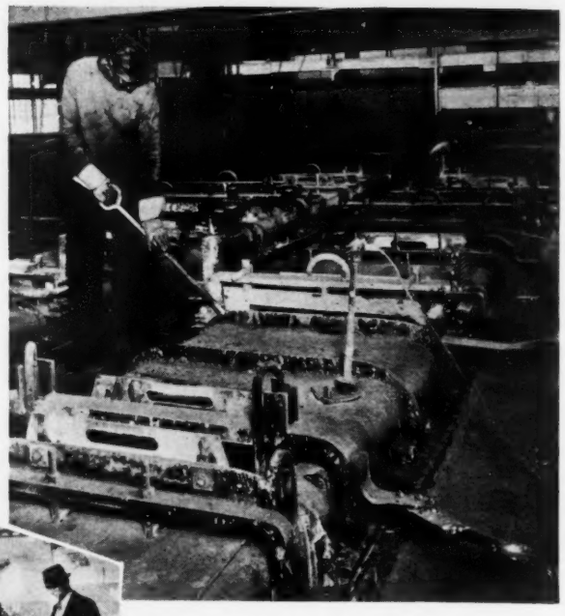
Right—Connections from buses to switch. The cells are normally in series. Either can be short-circuited.

Courtesy Bethlehem Steel Company



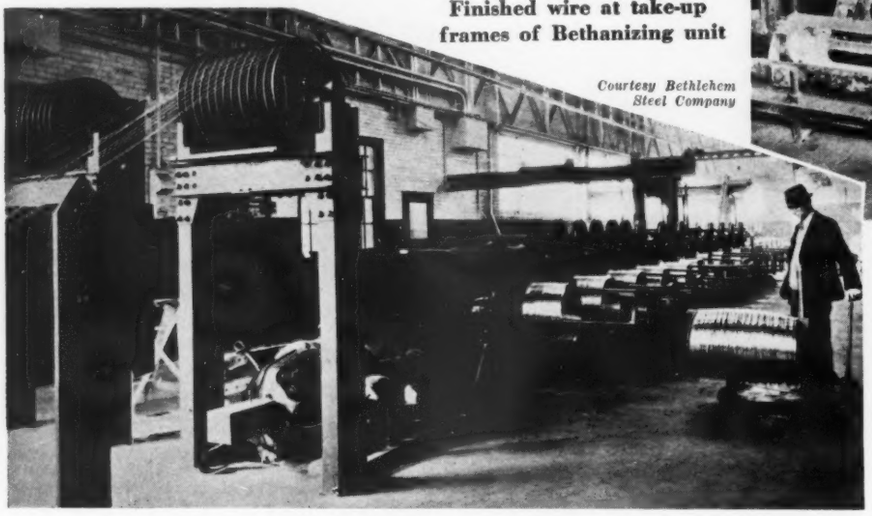
there is any zinc present. Purity of the zinc, especially freedom from iron contamination, in the zinc coating (hard to avert in the hot-dip process) is conducive to minimum of galvanic currents. The electrodeposition method (Bethanizing) assures an inherently pure deposit.

These, then, are the main technical bases for adoption and perfection of Bethanizing. But to execute the production process, there had to be development of power supply and of distribution to the tanks on a scale which called for solution of generation, bus and contact finger problems of unusual nature. These electrical developments are told through the medium of the accompanying illustrations and the details embodied in their captions.



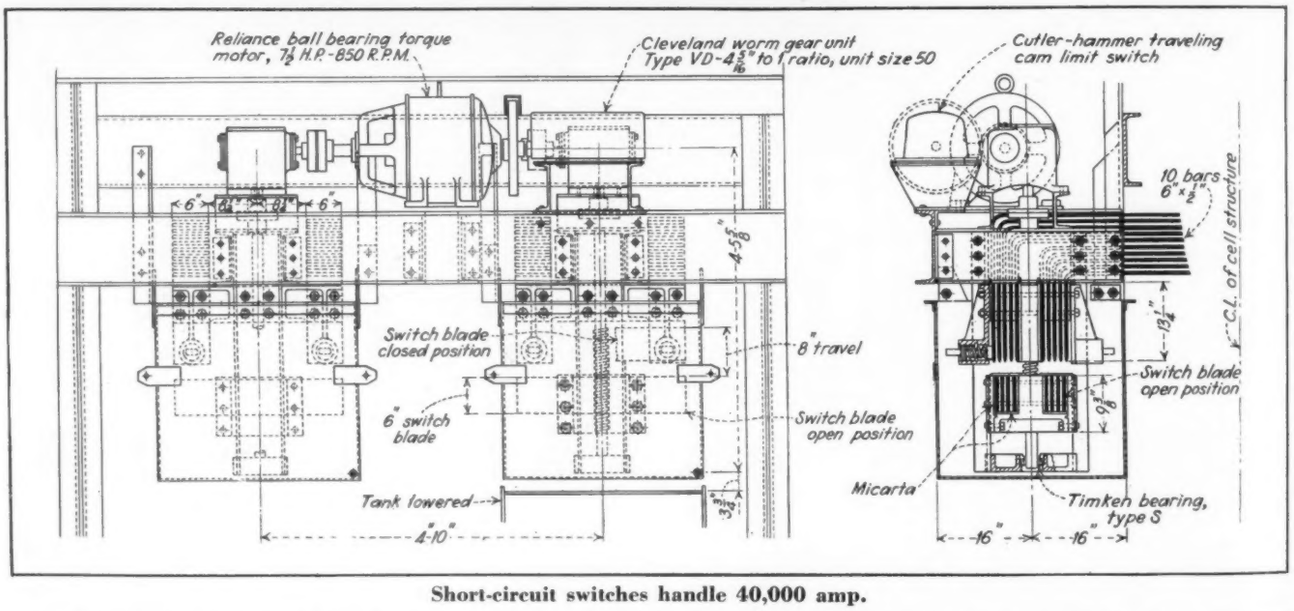
Finished wire at take-up frames of Bethanizing unit

Courtesy Bethlehem Steel Company



Molten caustic soda bath precedes deposition

After passing through take-up mechanism (to afford opportunity for welding splices) the steel wires pass into a bath of molten caustic soda. Next they pass into a cell containing a sulphuric acid solution. Each wire is here an anode, impurities are carried into the acid and the acid neutralizes traces of caustic from the preceding operation. Thence the wires pass into the deposition tank, containing a solution leached directly from zinc ore.



Short-circuit switches handle 40,000 amp.

In electrochemical processes employing large current values at low voltage it is often the practice to connect several units in series. This has the advantage of greatly simplifying the wiring, reducing the losses in the leads, etc. It has the disadvantage, however, that trouble with one unit will cause the shutdown of all the units, unless the connections to the cells are so arranged that the faulty cell can be shunted or shorted out.

At the Bethanizing unit of the Cambria plant of the Bethlehem Steel Company, which requires a current of 40,000 amp. at approximately 6 volts per cell, and which is operated with two cells in series, short-circuiting switches are installed to shunt the current from one cell so that one unit may be operated while repairs are made to the other.

The large size of the leads for 40,000 amp. limited the location of the switches to the space under the cells. The electrolyte in the cells has a high acid content, which made adequate protection to the switch contacts imperative. It was decided to immerse the switches in oil. No suitable switches of this character were found on the market except at prohibitive prices. W. E. Miller and the maintenance department were then given the task of building the switches. The decision was made to construct the switches in two units of 20,000 amp. each to keep their size within reasonable bounds.

They are of the knife-switch type, with double jaws instead of the conventional hinge and jaw. Ten blades of ½ x 6-in. copper are used in each switch, five blades being mounted on each side of a crosshead. The crosshead is moved up or down to pull the switch blades into contact or out of contact with the switch jaws by means of screws. The two switches are mounted close together and screws of each driven by a 7½-hp. motor through worm reducers so that the two switches operate as a single unit of 40,000 amp. capacity. Each switch is completely submerged in a tank of transformer oil, the operating mechanism for the screws being mounted on top of and outside the tanks, with the motor between the two. A limit switch is provided to prevent damage to the switch by overtravel in either direction.

Since the operation of the switch is anything but quick-break, heavy contactors are mounted in parallel with the switches to make the initial making and final breaking of the shorting currents so as to eliminate any burning of the switch controls themselves.

The switches have operated since installation without serious difficulty, although frequent inspections are made.

Revenue Up 7.2 per Cent

March Energy Sales Far Above 1936; Wholesale Commercial Increased 24.8 per Cent, Almost Breaking the Record

REVENUE of $177,579,300 received by the electric light and power industry during March exceeded last year's for the like month by 7.2 per cent and thereby continued the rate of gain recorded in the recent past, according to statistics announced by Edison Electric Institute. The previous record for March was $165,922,800 in 1930, virtually duplicated in 1936. As usual at this time of the year, the revenue curve is swinging downward, the March figure being about $17,000,000 below January.

An unusually large increase in energy production brought the latter item 16.6 per cent above last year's mark to 9,664,454,000 kw.-hr., close to the all-time record made last winter and far above the figures for any earlier year. Water power contributed little to the increase. Nearly 25 per cent more energy was generated from fuels than a year ago. This was a reversal of the conditions in January and February (Table I).

Energy production figures published for many years in the ELECTRICAL WORLD were based on U. S. Geological Survey reports (continued by the Federal Power Commission) with deductions for certain plants not considered to be in the electric light and power industry. Adjustments made by the Edison Electric Institute, when that series was begun, gave slightly smaller totals. Due to changes recently made by the F.P.C. its present figures are on a somewhat different basis than those formerly reported, and the E.E.I. figures have been used in Table I.

In contrast with the increase of 7.2 per cent in revenue compared with March, 1930, the corresponding kilowatt-hour sales advanced from 6,223,500,000 kw.-hr. to 8,216,989,000 kw.-hr., or 32 per cent, and the average rate for all classes of energy is now 19 per cent lower than it was seven years ago.

More energy was sold to ultimate consumers than in any month except January, 1937. Industrial activity is reflected in the great consumption of energy by wholesale commercial customers, larger than in any month except last October, and only slightly below the record made in that month.

During the twelve-month period ended in March the average consumption per domestic customer rose to 743 kw.-hr., a gain of 8.0 per cent over the preceding like period, the average rate declined 6.1 per cent to 4.63 cents per kilowatt-hour.

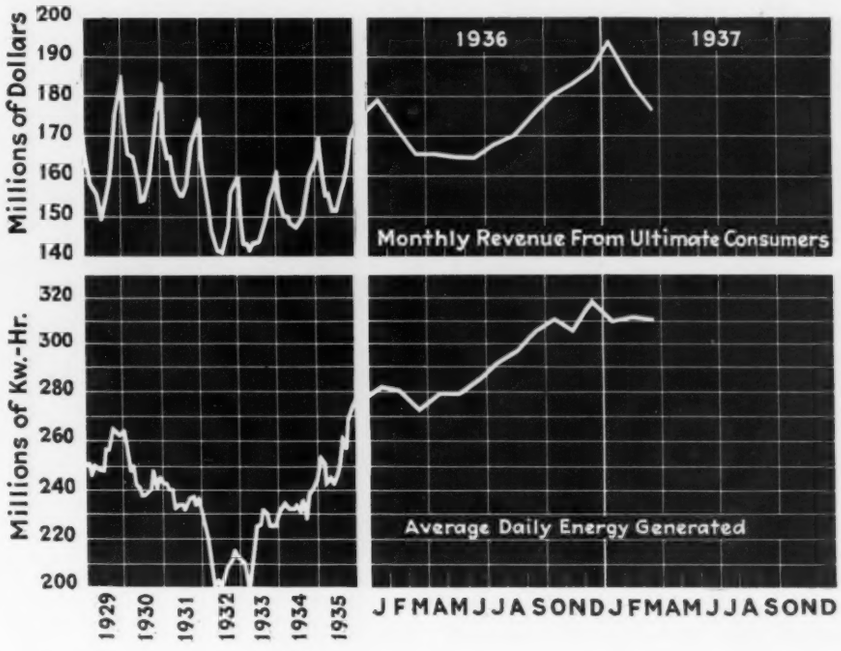


Table I—Monthly Revenue from Ultimate Consumers and Energy Output of the Electric Light and Power Industry

Compared with Corresponding Month of Previous Year

Month 1937	Revenue from Ultimate Consumers‡		Energy Generated, Millions of Kw.-Hr.*					
			Total		Hydro		Fuel	
	Thousands of Dollars	Per Cent Inc.	Gen.	Per Cent Inc.	Gen.	Per Cent Inc.	Gen.	Per Cent Inc.
March	177,579	+7.2	9,664	+16.6	3,624	+ 5.1	6,040	+24.7
February	183,586	+7.2	8,752	+ 9.6	3,261	+23.4	5,491	+ 2.7
January	194,554	+8.6	9,614	+11.5	3,605	+16.1	6,009	+ 8.9
▶ 1936								
December	187,094	+7.9	9,791	+15.8	3,246	+10.0	6,545	+18.9

* By courtesy of Federal Power Commission, with deductions for certain plants not considered electric light and power enterprises. ‡ Edison Electric Institute.

Table II—Allocation of Energy by Classes of Service, 1937

Compared with Corresponding Month of Previous Year (Edison Electric Institute)

Class of Service	March		February		January	
	Millions of Kw.-Hr.	Per Cent Inc.	Millions of Kw.-Hr.	Per Cent Inc.	Millions of Kw.-Hr.	Per Cent Inc.
Total for distribution*	9,908	+18.3	8,927	+11.2	9,792	+13.0
Lost in transmission, etc.	1,691	+15.6	954	− 7.1	1,433	+ 3.4
Sold to ultimate consumers	8,217	+18.9	7,973	+13.9	8,359	+14.9
Domestic	1,425	+13.7	1,573	+17.4	1,668	+13.7
Com'l, small light and power	1,451	+15.5	1,534	+15.9	1,616	+15.2
Com'l, large light and power	4,553	+24.8	4,115	+17.1	4,258	+19.4
Municipal street lighting	181	−13.7	184	−15.8	218	− 6.8
Railways — street, interurban	414	+ 5.3	401	− 7.9	410	− 8.0
Railroads — electrified steam	120	+14.4	95	− 0.1	118	+18.0
Municipal and miscellaneous	73	+ 5.9	71	− 1.9	71	+15.9

* Generated, purchased from other sources, imported, less energy used in railway and other departments.

The Conversion Heater as a Stepping-stone

New York Power & Light Adds 1,800 Conversion-Type Electric Water Heaters to Its Lines — Brings in New Revenue

By RALPH P. WAGNER
Commercial Manager New York Power & Light Corporation, Albany, N. Y.

THAT the electric water heater has had small acceptance is no reflection on the quality of the few heaters that have been sold or the amount of advertising, promotion and sales help given by both utilities and manufacturers. Rather, it has suffered from the customer's fear of high bills and the initial cost of equipment, especially when compared to the customer's present water-heating equipment.

Water heater unsurpassed as source of new revenue

As a source of new revenue, the electric water heater cannot be surpassed and, bearing this thought in mind, New York Power & Light Corporation began its search early in 1934, first for a heater and, secondly, for a plan that would allay both of the customer's fears.

After a thorough study of other companies' experiences and particularly those of Ontario Hydro and some utilities in the far West, we decided upon the conversion heater. Its appeals were many: It could be sold for less than $40; it could be sold to all classes of customers; it made use of the customer's tank and so gave him an opportunity to fall back to his former method of water heating if the electric heater was unsatisfactory; it was flexible and fitted most of the standard tanks, thereby reducing our inventory to a minimum; it could be sold for $1 down and $1 a month on a satisfaction guaranteed basis; it permitted the customer to try it at very small cost and so prove to himself that electric water heating was not expensive; it could serve as a stepping-stone toward the sale of a factory-built heater by the dealer; it lent itself to attractive promotion.

"We do not use the conversion heater as a substitute for a standard heater. We do use it to secure water-heating revenue from those customers who are able to purchase only the inexpensive installations.

"We feel that many of our 1,800 customers using conversion heaters will ultimately be good prospects for standard electric water heaters. Meanwhile we do not wait for their water-heating revenue."

•

These appeals became our plan, and the Hynes & Cox Electric Company, in Albany, manufactured and assembled for us a complete kit containing a 1,000-watt strap-on Nichrome heating element, thermostat, relief valve, sheet metal assembly, asbestos wire and mineral blanket insulation. The customer's present range boiler is used, to which the electrical contractor applies the strap-on heating element and the thermostat. The entire installation is then insulated and covered with a sheet metal outer casing. The prices to the customer, including the cost of installation, are:

30- and 40-gallon single-element assemblies	$34
(Larger sizes at special prices)	
Auxiliary elements and thermostats	$10

The customer pays for his heater at the rate of $1 a month. Seasonal customers pay $7.50 a year. If at any time during the contract the customer becomes dissatisfied he can have the heater removed without any expense beyond the payments he has made. If the customer does not own a tank, or if his present tank is not in condition for the application of a conversion assembly, the company will finance the purchase of a new tank, up to $18, for an additional payment of $0.50 per month. This plan does not include any changes in plumbing other than the removal of present heating equipment.

Our company does not install water heaters, either the conversion type or factory built, as all this work is considered to be in the province of the local electrical contractors. To them the company pays a flat sum of $13 for the installation of a conversion heater upon acceptance as evidenced by issuance of the Underwriter's inspection certificate and when the installation conforms to the company's good practice regulations.

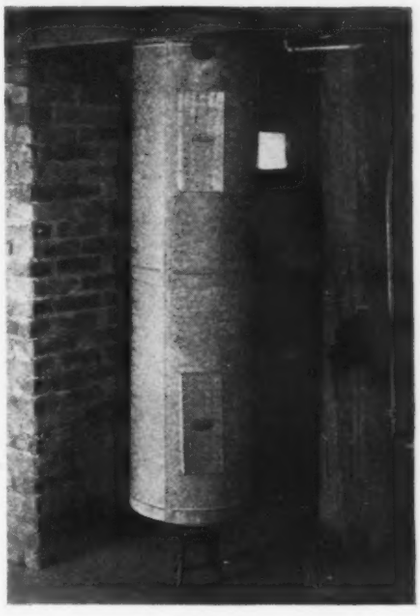
The conversion heater has its limitations and we have respected them. They can be too easily "over-sold" and

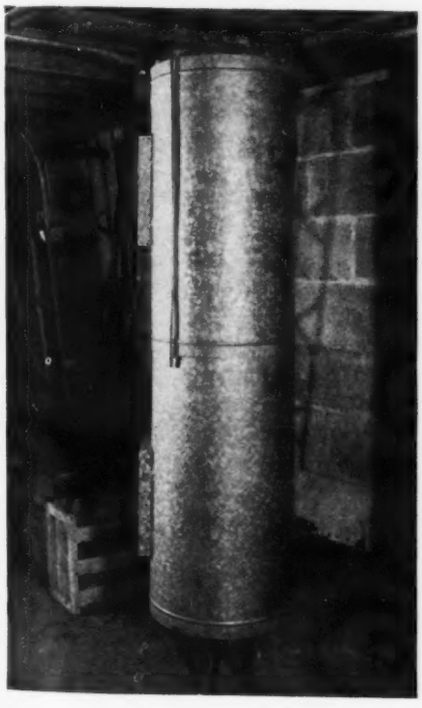
the resulting dissatisfaction might easily harm a long-term program. We have been extremely careful of our installations, readily admitting to a customer when an efficient installation could not be made.

For example, we have taken care to observe that the tank and the piping were in proper condition for these strap-on installations. The tank and the pipes should be free from scale. Both should be of ample size to permit a sufficient supply of water. The run from the heater to the point of most frequent use should be kept to a minimum to avoid substantial losses.

The Hynes & Cox Nichrome unit which we have used has the desirable characteristic of low surface radiation in watts per square inch. This is very important as a means of reducing the tendency for scaling and heater burnouts. If care is taken in insulating the tank the efficiency of strap-on elements is very high. The heating element is flexible and its design permits usage on any size tank from 30 to 82 gal. capacity. A second unit is, of course, required for larger tanks. A soft aluminum shoe is used to provide good contact with the tank surface and a low thermal gradient.

This small house needs some repairs and the coach on the porch indicates a new baby, yet there is a three-wire service for the electric water heater



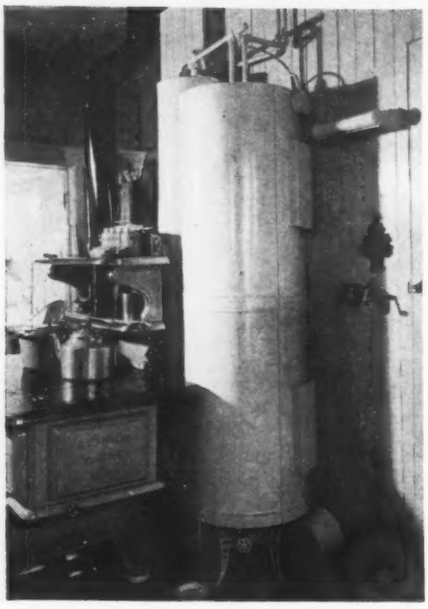


To us the conversion heater has been the means of providing the coal- or wood-using customer with a stepping-stone to the standard factory-built heater. We assumed that once a customer experienced the advantages of automatic hot water service at a very small investment he would continue to use it and it would be far easier for a dealer to sell that customer a standard heater at a later date. In the meantime, we were securing revenue which would otherwise not be available to us. Our entire sales plan is aimed in the direction of selling the standard factory-built heater, using the conversion heater as a tool. Bonuses to our own salesmen on the factory-built heater are 50 per cent higher than on the conversion heaters. The men are instructed to turn over to dealers all conversion inquiries which could be sold standard heaters.

In thousands of little homes like this house live families of five. They keep chickens in the side yard and yet use electric water-heating service profitably

The added load secured through these installations may be noted in connection with the accompanying illustrations. In the little house shown above a 1-kw. heater was installed

A more pretentious home, housing five, but sold on electric water-heating convenience in competition with a coal range shown in the illustration



on the 30-gal. tank serving a family consisting of two adults and one small child. The unit was installed July 3, 1936, and to date averages a use of 250 kw.-hr. per month.

In the neat little house shown on page 37 at the bottom a 1-kw. unit was installed April 15, 1936, to serve a family consisting of two adults and three children. Here also the tank is of 30 gal. capacity and likewise the usage is 250 kw.-hr. per month.

The two-story house shown above has a 40-gal. tank serving a family of five. This installation was made July 5, 1936, and has averaged 300 kw.-hr. per month. It will be noted that this installation is in the kitchen rather than in the cellar, and better results are obtained because the heater is nearer the point of use and heat losses due to long runs of pipe are avoided.

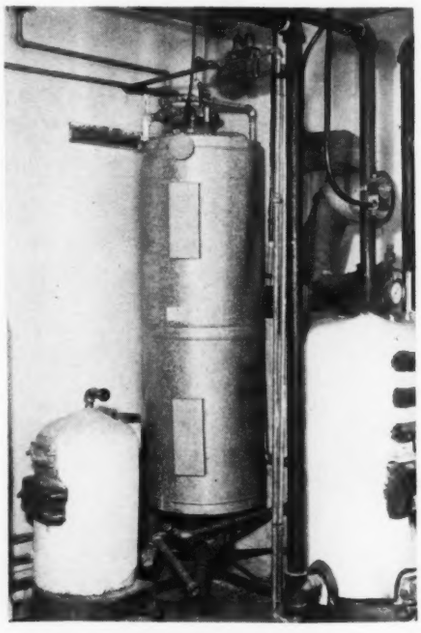
A fourth installation, shown below, is a 1-kw. unit on a 52-gal. tank. There are only two in the family, but usage since installation on June 6, 1934, three years ago has averaged 235 kw.-hr. per month. In this illustration there appears an old-fashioned coal stove which was superseded by the electric conversion heater.

In three years our company has sold about 1,800 of these conversion heaters, compared to the sale by dealers with company aid during the same period of 756 standard water heaters.

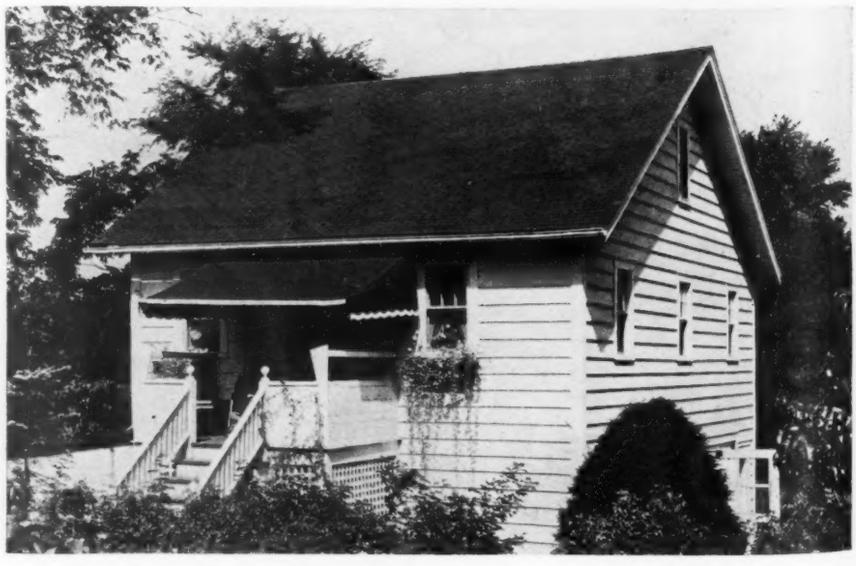
Conversion heaters have been sold at the rate of about 600 per year and we feel that with the improving economic situation our customers will favor the purchase of standard water heaters rather than these conversion jobs.

Our conversion job does have a distinct zone of application, however, in the case of the customer who cannot afford a standard heater. The conversion job may be the means of getting a new water-heater customer on the lines and bringing in revenue which otherwise would not be secured until the customer could afford to purchase a standard electric water heater.

In the three years we have been operating this plan our water-heater saturation in our straight electric area has increased from ¾ per cent to well over 7 per cent.



Another "little" house, but its appearance bespeaks a standard of living compatible with probably a modest income, which includes electric water-heating service



Economic Additions to Generating Capacity

A Simplified Yet Accurate Method of Comparisons for Determining the Best Plan for Making Plant Extensions With Due Regard for System Performance Over a Period of Years

By BEN C. SPRAGUE
Pittsburgh, Pa.

NOW that it has become economical in many cases to provide additional generating capacity by superposing over existing low-pressure capacity and by installing small plants at load centers, the determination of how best to provide for increased system load requires a study of many different plans. Where capacity is provided by superposition the additional production costs involved are very low, but the first costs per kilowatt may be higher than for a condensing unit installation. Because of this difference in characteristics, a careful study of the comparative system operating costs is required in determining which is the most advantageous method of providing additional capacity. Where comparisons must be made of superposition over low-pressure units at several existing power stations and of condensing unit installations at different proposed locations, the work required in accurately selecting the best plan is likely to become quite involved unless some simplified methods of comparison are adopted.

System costs comparisons

Inasmuch as the cost of providing the transmission facilities required in delivering the output of generating capacity additions to points upon the system where it can be absorbed by the existing transmission network vary with the different plans of generating capacity additions, the transmission costs and losses involved in this delivery must, in comparing different plans of development, be considered as well as the generating costs. This tends further to complicate the determination of the best location for capacity additions. It is the purpose of this article to describe some methods by the use of which this work can be simplified without sacrifice in required accuracy.

For proper comparison the various plans of development to be considered should include all facilities necessary for generating power and delivering it into the existing system. When several of such plans of possible development have been worked out and the problem is to select which is the most desirable, one of the first requirements after determining the construction costs in connection with each is to arrive at the effect on system production costs. Because the generating capacity added is usually more efficient than that of existing capacity used in carrying the system load, it is generally economical to operate the added capacity at a very high load factor, reducing the outputs of the previously existing units. Thus in determining the effects on system production costs, it is necessary to determine the proper distribution of the load between the various generating units and the resulting production costs for each station, which, summarized, gives the total system production costs.

In determining the energy outputs of the individual generating units of the system it is necessary to allow for the variations in load throughout the week and year and also for the effect of outage of units for inspection and repairs. Such determinations of unit outputs are conveniently made by use of a duration curve of system load as shown in Fig. 1. Here the actual duration curve is approximately represented by a curve made up of several straight line sections chosen to follow fairly closely the actual duration curve and to give the same load factor as given by the actual load duration curve. Such a simplified load duration curve is used because it can very easily be reproduced and because it simplifies the work of determining the energy outputs of various generating units.

Load duration sectionalized

Energy outputs of the generating units are obtained by dividing the load duration curve into sections, each representative of some portion of the system generating capacity. The portion of system capacity represented by a section can be taken as either a single generating unit or a number of units having the same production costs. The sections representative of different blocks of generating capacity are placed on the load duration chart in the order of preference in loading. Loading preference is determined both by the operating cost of the units and the requirements for providing the required reliability of service. Where for any reason certain minimum values of load must be carried on certain generating units or stations, it is convenient to insert sections at the bottom of the load duration chart representative of these minimum loads. Fig. 1 shows the portions of stations B and C required to be operated at certain minimum loads for insuring service reliability, with other portions of the stations loaded solely from considerations of economy. The minimum load required for service reliability is shown as greater in peak periods than in off-peak periods.

The purpose in drawing the various sections representative of station capacity upon the load duration chart being to obtain the energy outputs of the various units represented by measuring the areas inclosed within the load duration diagram, it is necessary that the capacity values shown for the various units represent their average available capacity rather than their maximum capacity when available. If such average available values were not used the outputs obtained for the units given preference in loading would be greater than could possibly be obtained. Such average available capacity should allow for outage for inspection and repairs to the turbine unit and condenser or for any other conditions tending to limit either the operating time or output of the units.

Since some portions of the necessary outage time can be confined to off-peak periods, thus giving a greater availability and hence higher average available capacity in the peak period, the sections shown on the load duration chart should show greater average capacities per unit at the left-hand or peak-portion of the chart.

Division of week by load periods

It will be noted in Fig. 1 that different sets of capacities have been used for these different periods of the week. In this case the different capacity values are representative of the equipment availabilities obtained in the (1) week-day peak periods; (2) the week-day off-peak periods, and (3) the week-end periods, including a portion of the Saturday load. It will usually be found that when the time in the week has been divided into these three periods by consideration of the different operating conditions that prevail, the typical loads obtained in the hours of the week assigned to each period will be fairly well grouped on the load duration curve within respective periods of the same duration as indicated in Fig. 1. This tendency for the hourly loads to group on the load duration curve in accordance with an assignment of the hours as between periods of different operating conditions can be tested by identifying the loads for each interval of time duration, with different colors representative of the different operating periods in the week in which each particular load is obtained. Where this is done the extent of grouping of loads from the different operating periods of the week can be readily noted by observing the grouping of the colors making up the load duration curve.

Since considerable work is involved in preparing load duration charts with generating capacities drawn in, it is important to have as few charts as possible. Thus it is desirable to avoid having to make separate charts to take care of the seasonal variation in system load or the variation in output of water power plants. In the case of many power systems the net effect of seasonal variation in load or water power output can be offset by properly scheduling the outage time for that portion of the steam-generating equipment outage that can be controlled, such as inspections and general overhauling.

Load and capacity curve

Fig. 2 shows a load and capacity curve for a power system not having water power. The load is shown to be increasing at a constant rate from year to year with a uniform seasonal variation. Where capacity additions are made annually it is more desirable, in the case of such a load, to make the new capacity available at the time of year when the load first attains the value of maximum peak previously reached. These times are indicated on the load curve and capacity additions are shown to be made at these times. The curve of nominal installed capacity thus represents an annually stepped curve. The actual capacity of the installed generating units to carry peak load is shown varying throughout the year due to the effect of the varying water and air temperatures.

By adjusting the controllable outage of units as shown in Fig. 2, it will be seen that the amount of capacity left available as a reserve to provide for uncontrollable outage of units is maintained very nearly uniform. Where the amount of necessary unit outage which can be controlled is so adjusted as to result in an approximate equalization of the available reserve capacity, the unit outputs for yearly periods can be very accurately obtained from a single load duration chart as illustrated in Fig. 1. When so applied to cover a year, the load duration curve should be drawn to represent the load of an average week or month rather than for the year itself. When so determined, the load duration curve will have as its peak the average value of load in the weeks or months (depending upon which is used) making up the year, rather than the maximum load in the year.

Having drawn a load duration chart and laid out sections representing the average available capacity of the various portions of system capacity, the outputs of the units represented can be readily obtained either by use of a planimeter or by computation, using the average capacity values for the various sections which can conveniently be marked on the chart and the percentage of time duration as read from the abscissa scale of the chart. Taking 100 per cent time duration as representative of the 8,760 hours in the year, the areas can thus readily be converted into kilowatt-hours annual energy output. Having estimated outputs of the various generating units and the average values of load which they carry at the time of the weekly or monthly peak, all of which is obtainable from the load duration chart, the production costs for each station and the total system production costs can be readily computed.

By preparing charts and making determinations such as above described for three values of system load a curve can be plotted of total system production costs against system average annual load, which will serve for giving the production costs for intermediate values of load.

Priority between two plans

The comparison of different plans for providing additional system capacity requires the making of a set of system production cost determinations as above described for each plan to be considered. The simplest problem of this nature is found where there are only two methods of providing capacity to be considered and the one method not chosen as a first addition is to be employed when the second addition is made. Here the problem is simply one of determining which of two plans is to have priority. In this case the solution can best be obtained by estimating the system loads in each year during the period between the time of making the first installation and a time when both installations would be required, with either plan considered as a first addition. Such a period of time will completely cover the period affected by the alternate plans, and by summarizing the production and fixed costs resulting in each year with each of the two plans, a comparison can

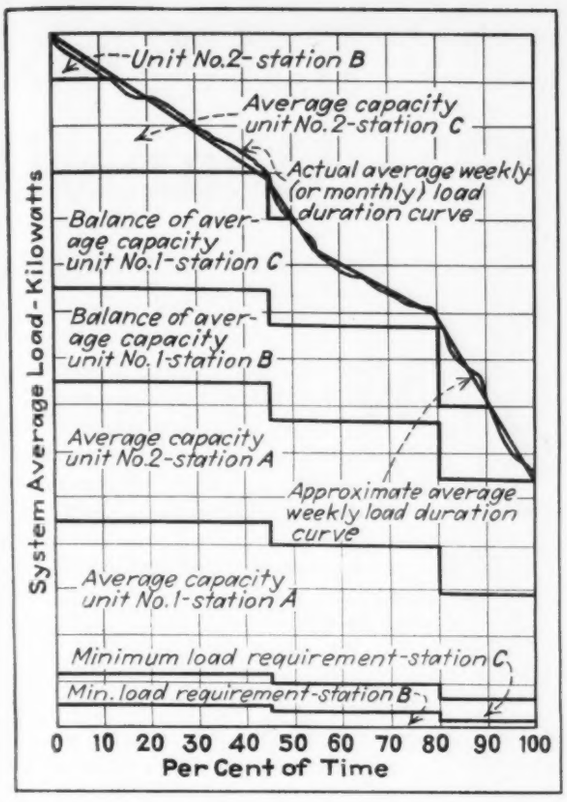

Unit No.2-station B
Average capacity unit No.2-station C
Actual average weekly (or monthly) load duration curve
Balance of average capacity unit No.1-station C
Balance of average capacity unit No.1-station B
Average capacity unit No.2-station A
Approximate average weekly load duration curve
Average capacity unit No.1-station A
Minimum load requirement-station C
Min. load requirement-station B
System Average Load-Kilowatts
0 10 20 30 40 50 60 70 80 90 100
Per Cent of Time

Fig. 1 — Load duration chart

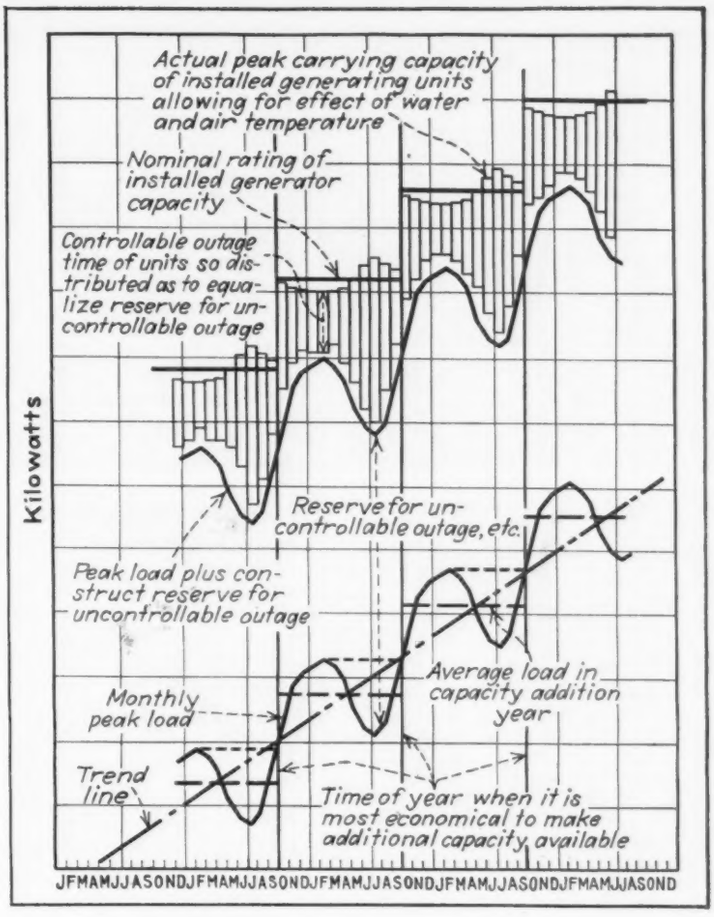

Actual peak carrying capacity of installed generating units allowing for effect of water and air temperature
Nominal rating of installed generator capacity
Controllable outage time of units so distributed as to equalize reserve for uncontrollable outage
Reserve for uncontrollable outage, etc.
Peak load plus construct reserve for uncontrollable outage
Average load in capacity addition year
Monthly peak load
Trend line
Time of year when it is most economical to make additional capacity available
Kilowatts
JFMAMJJASONDJFMAMJJASONDJFMAMJJASONDJFMAMJJASOND

Fig. 2 — Steam station load and capacity curve

be obtained which will show which plan is the more favorable.

Where the period between the first and second additions covers more than two or three years it is desirable to make allowance for interest on the difference in annual costs in determining the difference in total costs. This can be done by setting up the annual sums of fixed and operating costs for each plan covering a period starting with the making of the first addition and ending with the making of the last addition required with either of the two plans involved. The total summarized costs for each of the two plans can then be computed as of a certain date by allowing compound interest on each of the annual cost values to the date determined upon.

For example, if a small addition at one location which would take care of requirements for three years in the future (plan A) is to be compared with a larger addition at a different location which would provide for five years' load growth (plan B), the total annual cost involved for a five-year period after the date of first installation should be computed with compound interest to the end of the five-year period. The resulting total costs with compound interest covering the entire period affected by the decision as to which plan is to be given priority will permit of determining the economic results of the two plans.

Where rejection is final

In cases where the plan rejected as a first addition is not to be adopted as a second addition, the selection of which of the two plans is the most advantageous is a more difficult matter. Here the comparison must reflect the difference in costs over a long period, during which one and possibly several further additions of capacity will be made. The result of making the further additions of capacity will be to alter the comparative conditions under which the additions under consideration as first addition would operate, and hence the comparative economy of the plans should be considered for these latter periods as well as for the periods in which the additions under consideration remain the last addition made to the system.

In simplifying the work required when several plans are to be considered, it is desirable, at least in making preliminary eliminations, to limit the determinations of production cost to one value of system load for each condition considered. Such determinations can be made for the maximum values of system load that can be reliably carried with the system capacity existing after each particular addition. By comparing the sum of system annual production costs obtained when carrying the maximum load that can be reliably carried after the addition, plus annual fixed charges on the additional facilities, with the system production cost obtained with the maximum value of system load that can be reliably carried before adding capacity, a difference in cost will be obtained which, divided by the difference in the maximum loads that can be reliably carried, will give values of additional annual cost per kilowatt of additional reliable peak carrying capacity provided. Unit additional costs obtained in this way for each of the proposed additions can be directly compared even though the additions be of different size.

Comparison in this manner, however, fails to allow for the effect of

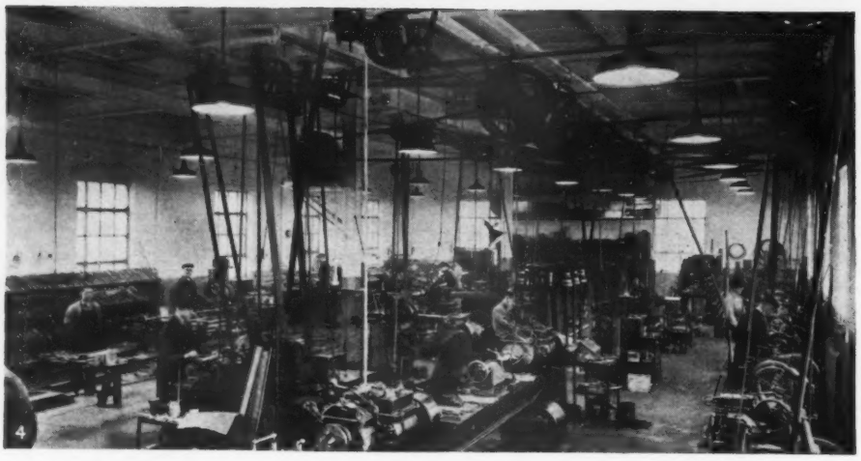
[*Continued on page* 94]

What Good Means to

By DEAN M. WARREN
General Electric Company, Nela Park

MANAGEMENT is coming to appreciate that business survival is related to better working conditions for the employee. By providing a pleasant working environment the employer not only receives direct compensation in the tangible form of increased employee efficiency but there also results an improvement in employee morale, which, although intangible, is necessary to harmonious plant management. With better lighting, the management is serving its best interests because it not only begets better productive effort but also thwarts the spirit of defeatism which appears to be an underlying cause of labor unrest.

Recently we visited a number of different industrial plants in Ohio, Pennsylvania and New York which had been relighted entirely or in part during the past year, and each executive had a result story to tell. The key



1. Dry Cleaning Works

Marriott's French Dry Cleaning Works, Inc. Rochester, N. Y.

Illumination of 30 ft.-candles provided by 300-watt lamps in Glassteel diffusers on this line of ironers. The number of returned garments reduced to one-tenth of previous figure and the rate of production increased 24 per cent, at least a third of which is attributable to improved lighting.

2. Rubber Factory

Aetna Rubber Company, Cleveland, Ohio

Fifteen ft.-candles in battery case molding room attained with 200-watt lamps in R.L.M. dome reflectors on 7-ft. centers. Over-all spoilage reduced 30 per cent and night production increased until it now equals day production. Complaints from men who did not like to work on the night shift have stopped since relighting.

3. Textile Mill

Federal Knitting Mills Co., Cleveland, Ohio

Spaced on 9-ft. 9-in. centers over work areas in inspection and packing room, 200-watt lamps in R.L.M. dome reflectors provide 15 ft.-candles. Workers experience increased ease in handling inspection work and are able to make more thorough check for spots, dirt, defects and tears. They are less fatigued as a result of eyestrain.

4. Machine Shop

J.&A. Keller Machine Co., Buffalo, N. Y.

Illumination of 20 ft.-candles in fourteen-man machine shop attained with 300-watt white-bowl lamps in R.L.M. dome reflectors spaced 10 ft. apart. After relighting and repainting the shop men were more alert and plant housekeeping, a potential accident hazard, was made easier. Men find they can see to make adjustments and settings on machines in a fraction of the time formerly required.

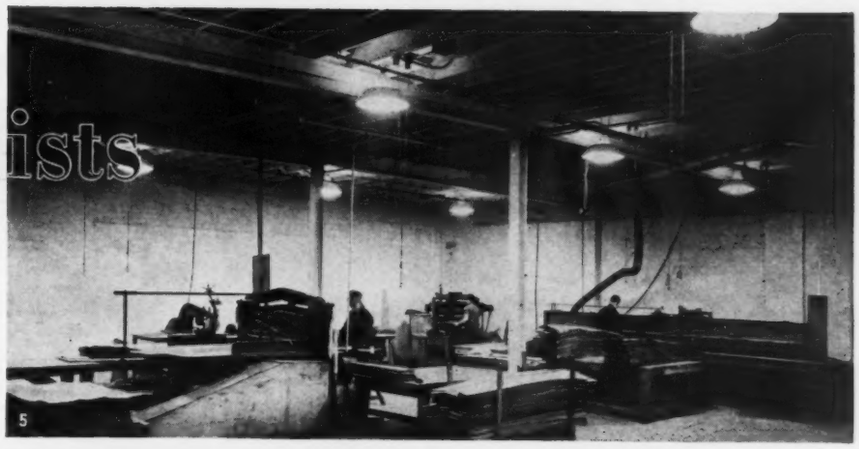
Lighting Industrialists

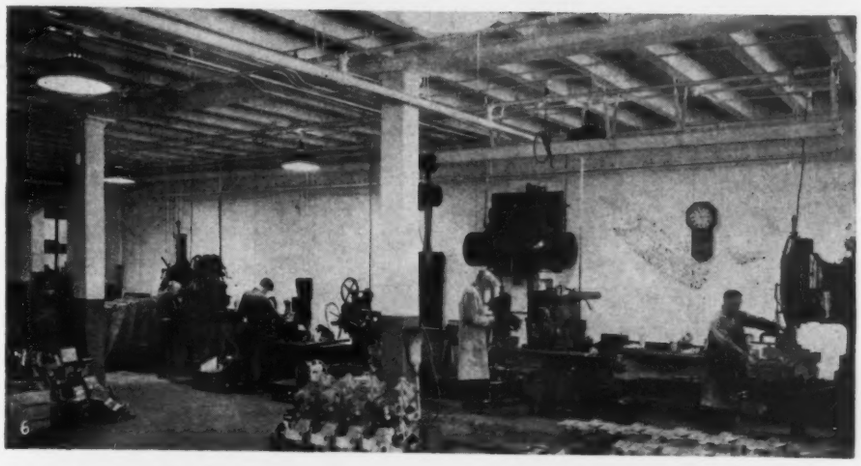
and A. K. GAETJENS
Engineering Department Cleveland, Ohio

theme of all was the same—employee satisfaction. The executive was interested first in providing a good working environment for his people, thereby improving their mental attitude and contentment, and, secondly, in the by-products which resulted, such as decreased production costs, reduced spoilage, better inspection and improved quality.

Lighting is the servant of both the large and the small factory. The personnel of the plants visited varied from six to several hundred and the small plant owner found the lighting paid its way just as did the executive in the large factory.

Employers are more conscious today than ever before of the human element in production and more and more of them are giving the employee sufficient light to enable him to see quickly and accurately and not just enough for barely seeing.





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5. Plywood Factory

Setter Brothers, Inc., Cattaraugus, N. Y.

Irregularly spaced Glassteel diffusers housing 250-watt mercury and 300-watt incandescent lamps provide 30 ft.-candles for matching grain and checking imperfections in plywood sheets. Work formerly done under droplights. Workmen are enthusiastic about the new lighting and the management is convinced that it is an indispensable aid toward insuring a quality product.

6. Machine Tool Factory

Davenport Machine Tool Company, Rochester, N. Y.

Type H-1, 400-watt mercury lamps in industrial reflectors with glass-diffusing shields, spaced 13 to 15 ft., yield an illumination of 30 ft.-candles on machines. Men report that general lighting saves the time necessary to rearrange the local lighting units and enables them to adjust tools more quickly.

7. Photo-Engraving Studio

Frontier Engraving Service, Buffalo, N. Y.

Illumination of 100 ft.-candles is provided on the easels by 150-watt lamps in projectors and 200-watt lamps in R.L.M. reflectors spaced 4 ft. apart. "Masking," an extremely exacting task which requires painting of lamp black on cellophane, formerly caused these artists to have headaches frequently. With new lighting annoying reflections are eliminated. As one artist said, "Now we don't go home half blinded at night."

8. Sign Factory

Bastian Brothers Company, Rochester, N. Y.

Three-hundred watt lamps in Glassteel diffusers, spacing 8 ft. by 10 ft., provide 23 ft.-candles. Says the superintendent: "The employees appreciate the difference between the old and the new lighting. Even if the improved lighting should bring us no other tangible benefits, its installation will be considered well worth while because of the improved morale of our employees."

Engineers Must Share in Continuing Property Records

Refined Accounting Accuracy for Tax and Regulatory Purposes Enhances the Necessity of Greater Participation of Engineer With Accountant on Physical Plant Entries

By **BERNARD S. RODEY** *

Associate Comptroller Consolidated Edison Company, New York

Recent developments in regulation, state and federal, require that the dollars in the property accounts be related in detail to comparatively small units of plant. Furthermore, the changes in these plant units due to additions, replacements or betterments are to be correctly accounted for as a routine matter. These basic requirements can only be accomplished by the accountant if the engineer has a complete understanding of the principles and will report to the accountant pertinent facts of physical changes in property.

THE original uniform classification of accounts issued in 1907, the later modification in 1923 and the present complete revision by the Federal Power Commission and National Association of Railroad and Utilities Commissioners have progressively required more detailed accounting of plant costs. The present requirements necessitate not only careful study on the part of the accountant to re-educate himself in terms of phraseology and methods but also require substantial co-operation on the part of the engineer, to whom the accountant must look for factual information concerning physical changes in the property.

There has been considerable argument and debate over what constitutes a unit of property. During the past three years some of the state commissions have made mandatory a System of Continuing Property Records, but as yet there has been no substantial national progress toward determining the scope and limits of a unit of property. At the present time there are two schools of thought; one believes that the units should be very large in order to avoid excessive accounting and detail of records, and the other, that they should be very small in order that the Plant Accounts may be maintained with a high degree of accuracy. There still exists great confusion as to the meaning of the term unit of property.

This confusion is partially responsible for the present differences of opinion in respect to large units and small units. In order to clarify this situation, it is proposed to explain the various uses of the term "unit" and their possible application to the Primary Plant Accounts, Subaccounts, Job Orders, Continuing Property Records, Retirements, Plant Inventory, and Plant Inventory Measurement. The minimum division of the property underlying the cost classification, which is selected to be continuously associated with its past in the property record system, may be defined as the *"Continuous Property Record Unit."*

The principal component parts of a Continuing Property Record Unit which are worthy of separate itemization in the record, the cost of which is not required to be recorded separately in the record system, may be defined as *"Plant Inventory Units."* The quantitative measurement of the Plant Inventory Units may be defined as the "Inventory Measurement Unit."

Those items of Electric Plant which, when removed or abandoned, with or without replacement, are accounted for by crediting the book cost thereof to the Electric Plant Account, in which they are included, may be defined as the *"Retirement Unit."*

Various units differentiated

Frequently, in practice, some of the above units may be identical. For example, a section of cable between two manholes may be the Continuing Property Record Unit, the Plant Inventory Unit and also the Retirement Unit. However, in such cases as boiler plant equipment, there is ordinarily no sound reason for subdividing or apportioning the cost of the Continuing Property Record Unit between the several related Plant Inventory Units of which it is composed. A boiler or battery of boilers may be a reasonable Continuing Property Record Unit, whereas each boiler, setting, water wall, etc., may be a reasonable requirement of a Plant Inventory Unit. It is to be noted that the Plant Inventory Units may quite generally constitute reasonable Retirement Units.

The accounting costs of doing the work will be excessive if the Continuing Property Record Units selected are too small in scope. Likewise, if the Plant Inventory Units are too small, the Field Inventory costs will be excessive. Further, if the Retirement Unit is also too small, the accounting

* Abstract of paper presented at E.E.I. Engineering Meetings at Chicago, May 4, 1937.

Accountant's Job

1. To co-operate with the engineer in the determination of the type of record to be installed, the subclassifications to be established and the scope of units which are to be used.

2. To prepare the necessary cost analysis of the Plant Accounts for the pricing of the basic inventories.

3. To determine as far as possible the purchase costs of the Continuing Property Record Units and in the case of the larger units, their cost of installation, where such information is available from Work Orders and accounts. To determine from an analysis of the books suitable unit costs for pricing the smaller and more general units, such as General Equipment and Outside Plant Properties.

4. To co-operate with the engineer in the apportionment of the costs to the Continuing Property Record Units where such costs are not available from the cost analysis.

5. To reconcile the priced basic inventories with the Plant accounts and make the necessary book adjustments in order that the two may be brought into balance.

6. To establish the basic Property Record as a subsidiary accounting record, eliminating such existing subsidiary records as may be superseded by the record. To provide, as to whatever extent may be practicable, the utility of the records for other company operations.

7. To analyze currently all Work Orders and Retirement Orders in connection with the current additions and retirements, to associate the costs with the field reports, to prepare the necessary debits and credits to the book accounts and to delete the units removed and add the units installed in the Continuing Property Records. To maintain the Continuing Property Record in balance with the books.

Engineer's Job

1. To co-operate with the accountant in the determination of the types of record to be installed, the subclassifications to be established and the scope of the units to be used.

2. To carefully review existing operating records and determine the extent to which they can be utilized in the preparation of the basic inventory.

3. To plan and supervise the preparation of any field inventories required for the basic records.

4. To assist the accountant in the apportionment of the costs applicable to the Continuing Property Record units, where such costs are not available from the analyses of Work Orders or accounts.

5. To establish a practicable and economical means of providing the accountant currently with accurate records of the additions and retirements of plant, arranged and classified in the same manner as the basic records.

6. To acquaint the various operating departments which are involved with the requirements of the Continuing Property Records and assist the field forces in the proper allocation of costs to Work Orders.

costs again will be excessive due to the additional accounting detail required. There will also result a distortion of the costs between those which are normally considered to be chargeable to repairs or maintenance and the charges to the depreciation reserve for property losses.

The various units must be selected with care and discretion, not only to permit the operation of the Continuing Property Record on a sound economic basis but also to establish, as nearly as possible, the correct dividing line between capital and maintenance charges. Again, it seems that one of the engineer's responsibilities is to understand the fundamental accounting principles in order to help in the selection and establishment of the most appropriate units of property.

Physical plant records available

It will be found at the outset that in most companies cost records for various kinds of physical properties have been maintained, in more or less complete form, in different departments for their own individual purposes. The operating and engineering departments, for instance, have their records of line transformers and devices, meters, overhead and underground lines, etc., showing location, quantities, sizes and other information necessary for a complete property record, except perhaps detailed costs. Similarly, the power plant and substation departments maintain records of the main items of equipment under their jurisdiction. Also, the statistical divisions will undoubtedly have their records showing summaries of property of various kinds, and the accounting department has records showing property investments in more or less detail. This may likewise be found true in other departments.

It is the purpose of the Continuing Property Record work to centralize all this information and keep complete over-all records with detailed related costs in complete form. As the functioning of the system becomes more and more comprehensive, departmental records should be eliminated and the necessary information, when needed, obtained from the centralized records. Certain departmental records must, however, be maintained on account of the heavy continued use made of them in connection with operations.

Starts with inventory

The first step toward the establishment of basic Continuing Property Records in an operating company, after a general determination of the scope of the various units and cost classifications, is the preparation of a physical inventory of the property or the adoption of an existing inventory already prepared and corrected to date. Such an inventory should include a count of all property units or items property chargeable to the Plant Accounts, classified in accordance with the Uniform System of Accounts.

The next step is to make a complete analysis of the Fixed Capital Accounts in so far as it may be necessary or practical, for the purpose of associating each Continuing Property Record Unit of the inventory with its original cost, where available, or cost as determined by using relative values and a consideration of past experience in similar work. At the outset a statement of the book costs by accounts would be required for the purpose of establishing a working control. A supplementary statement of work in progress showing the Job Orders or contracts, and the bookings to date, should be prepared to identify that portion of the physical inventory at the time of initiation which applies to unfinished construction.

In setting up a Continuing Property Record for Outside Plant two general plans are in common use. The first is frequently referred to as the "Specific Cost Method" and the second is the "Average or Area Cost Method."

The "Average Cost Method" is a method whereby average costs for a year of a group of similar items is determined for an area such as a map area. When one of these units is retired the average unit cost for that year for that particular area or group is used for retirement purposes. The

[*Continued on page* 98]

Editorials

Senator Norris Admits Power Is Main Object of 7-TVA Bill

THROUGHOUT the life of TVA the country has been told by those who are administering that project that power is merely incidental, that the primary purpose has been flood control, navigation improvement and prevention of soil erosion. In the President's new bill for seven similar districts throughout the country, which had been sent to Congress as a further measure for flood and navigation control, power again was relegated to the background.

This past week, however, Senator Norris let the cat out of the bag. The bill had been referred to the committee on agriculture, of which Senator Norris was a member, and which committee had previously handled the TVA bill. Senator Copeland insisted that the bill be sent to the commerce committee because that committee handles flood-control measures. This was too much for Senator Norris, who stated: "It is not a question of navigation, although that is the constitutional peg on which the legislation hangs. It is not going to be a question of flood control, although that is a constitutional privilege."

Senator Norris has done the country an extremely good turn by making this admission. The utility industry has contended all along that in these vast river developments flood and navigation control were but incidental; that the primary purpose was power development. Now the leader of the administration forces admits that flood and navigation control are merely constitutional pegs on which such measures might hang. Will those threads of constitutionality be strong enough to support these top-heavy structures?

•

Who Is to Assume the Servicing Responsibility?

UTILITY men charged with the responsibility of developing profitable new loads for their companies can well afford to cast a weather eye at the growing cost of appliance servicing. The problem is becoming increasingly important due to the large volume of appliance sales and the increased percentage of sales made by dealers. Thus, a company which has used dealers extensively in large-scale merchandising programs faces the question as to who is to service these appliances over the period of time they are connected to the lines, and on what terms.

That the utility cannot afford to bear this expense single handed is apparent from details of a new servicing policy described by R. E. Fisher at the Edison Electric Institute convention this month. In one of the small divisions of the Pacific Gas & Electric Company new range purchasers are being told that the company will maintain the range it sells in good operating condition for one year. Subsequent to that period replaced parts will not carry a guarantee and a labor charge of $1 per hour will be made.

The company has notified dealers that they are expected to maintain ranges they sell on the same terms, which correspond with the conditions of the manufacturers' guarantees. The company will help the dealer, as he may require, by making range repairs on a time and materials basis, both during and after the guarantee period.

This trial plan seems to be eminently fair to the customer, the dealer and the company, for it allocates the responsibilities of the dealer and the company according to the advantages each party has derived from its respective sales, and yet provide dependable channels for the servicing needs of the customer.

Here is an effort to solve what may become a vexing problem to the industry and the results of the experiment will be watched with great interest.

•

Steel Electrogalvanizing a New Energy Consumer

ELECTROGALVANIZED wire is a commercial reality. As a process, it takes amperes in gargantuan magnitudes to deposit the zinc on a fast-moving wire. Sheets and rods are next in order, and when their electrogalvanizing goes into commercial production there will be just that much more fulfillment of the prophecy that industry has hardly begun to consume kilowatts to make more products better through the refinement afforded by electricity.

Good as galvanizing with good commercial zinc can be, there was nevertheless an improvement to be secured from higher purity zinc. Elimination of local action and of the mechanical weakness of the coating that results from residual impurities carried in commercial zinc could be attained by employment of the "four-nine" (purity of 99.995), which provides the basis of the process developed by the Bethlehem Steel Company for electrogalvanizing wire as described elsewhere in these pages.

A novel feature of this operation is the introduction of a cleaning method which gives promise of being a distinctive improvement over the conventional acid pickling employed for that purpose. Instead,

the steel wire is made cathode in a fused bath of anhydrous sodium hydroxide (caustic soda). The nascent soda materally aids in the removal of all non-metallic inclusions and impurities by reducing iron oxides back to metallic iron, thus giving a perfectly clean metallic surface for deposition of high purity zinc in an ensuing electrolytic bath. Here the zinc is supplied in the form of purified electrolyte prepared from roasted zinc concentrate carrying about 69 per cent zinc which has been dissolved in the 25 per cent acid return electrolyte circulated from the electro-deposition cells. Impurities are removed and thus only pure zinc sulphate is fed to the tanks and at a rate just equal to the depletion of zinc as a deposit on the wire moving through the cells. Current density is between 750 and 2,000 amperes per square foot of wire surface.

Plating has always been a generous user of current, but when it reaches out to embrace electrodeposition of zinc on a fast-moving wire as an alternative to conventional galvanizing it ushers in a new outlet for energy and electrical equipment.

•

A Cubic Foot of Copper

IN 1911 a group of men representing the leading producers and consumers of copper honored Thomas A. Edison for the market for this metal which sprang from his inventions. When asked what he would like to have to commemorate this occasion, Mr. Edison asked for a cubic foot of copper. This he received. This story is told in a small book of limited edition, by George E. Stringfellow, called "A Cubic Foot of Copper."

While the story here, of course, is the tremendous national business that has arisen out of the inventions of one man, it left one thinking of the wealth and employment contributed by the electric utility industry outside its own corporate limits. Does other business understand or appreciate the benefits that have accrued to it out of the development of the power industry?

How many industries depend wholly or in large part upon the power industry for their business?

How many industries owe their start to the supply of cheap and plentiful electrical power?

What has the industry done for the markets for coal, metals and oil, for chemical materials and for forestry and agricultural products?

If all other beneficiaries of electric service were to ask the electric utility industry, as the copper people in honoring Mr. Edison asked him, in what tangible way they could acknowledge their appreciation, what would the industry say? We think it might say: "Your best gift to us would be a gift to yourself. Help us to keep your market and employment on an ever upward trend. Just remember that any unjust tax or limitation or legislation against the utility industry is a blow to you and your employees. When our position is hurt through slander and misrepresentation, you and your employees feel it. You cannot stand silent as we are attacked."

Of course, it is only a dream, but if the benefits from a strong and healthy power industry to mining, forestry, agriculture and industry were appreciated, and especially their employees were to understand this mutuality of interest and would react accordingly, we would see less anti-utility activity.

•

Economic Extensions to Power Plants

MOST utility systems are faced with the necessity of considering additional capacity as the result of recent load growths. The decision with regard to the size and character of such extensions must be based upon a consideration of economic results over the life of the new equipment, upon the effect of this added plant upon the system as a whole and upon its reliability as an integral part of the interconnected system.

The plant performance of the new addition can be determined quite closely, and if two or more methods of increasing capacity are reviewed, the plant performance and fixed charges of each will be determined. But what about the effect of each proposed extension upon the system as a whole? This must be considered, for the base load will generally go to the new units, leaving the older plant to operate at lower use factors. Further additions in the future should also be analyzed, for these in turn will take the base loads from the plant under present consideration. In that case, how will the immediate extension perform under decreased use factors?

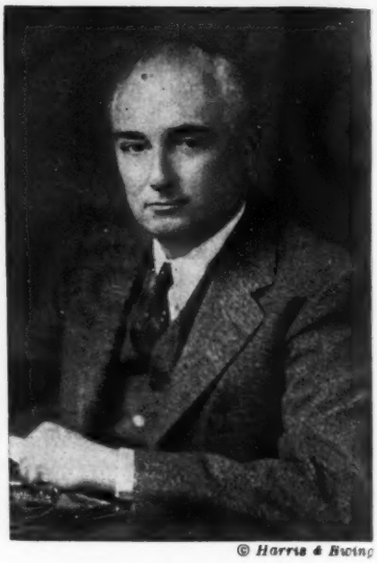
Location for the new plant must also be considered, inasmuch as the cost of transmission and distribution systems must be included in the economic study of the total plant. The reliability of each element of plant, its necessary outage for maintenance and its availability in emergencies are also factors in the final decision.

Any method that will reduce the time and cost of making these necessary comparative studies will appeal to both executives and engineers. In this issue B. C. Sprague outlines such a method in his paper on "Economic Additions to Generating Capacity." This will repay careful study, since its application may save time and money.

The economic selection of added equipment is one of the most difficult problems in utility practice. It involves studies of the system as a whole, its probable load growth, the effect of such growth upon the use of the various generating elements in the system and, finally, the effect of any extension upon the reliability of service at the customer's meter.

Money for TVA and PWA Loans

By CARTER FIELD



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This noted journalist gives his personal comments and interpretations on current happenings affecting the electrical industry. His background and his location at Washington make his thoughts informative and interesting even though all may not agree with him

DESPITE the economy wave temporarily restricting government expenditures, and despite the present tie-up by court injunctions of PWA loans to local governments for power purposes, there is little use for the electric industry to delude itself into thinking that the worst has passed—that government competition has been stopped in its tracks—if not turned backward.

The plain prospect is that the government yardstick will continue to stalk through the land and that money will be found for additional TVA and PWA loans to cities.

This "economy" talk should not be taken too seriously, anyhow. Wait for the final figures before concluding that the government is going to spend a great deal less in the year beginning July 1 next. But entirely aside from this, the contention can and will be made that the "loans" will be repaid with 4 per cent interest, and that the "grants" are cheap indeed considering the burden lifted from direct relief.

It is not important whether this contention is sound or not. President Roosevelt may want to economize, but he wants a great deal more to go on building yardsticks and cutting electric rates. And there are other motives. Most observers are familiar with his economic logic, by now—higher wages, shorter hours, enormously reduced profits, low interest costs, eventual government control of plant expansion—in fact, planned economy. But one difficulty is that most of the moves in this direction boost costs, therefore prices, and thus tend to reduce purchasing power, playing hob with the entire calculation.

It just so happens that the electric industry is one of the few instances so far discovered by the Brain Trusters where government intervention actually reduces the price to the consumer, and thereby tends to *increase* the buying power of the workers. It is perfectly true that the cost of electricity to the average worker is nothing for a student of household budgets to get excited about. It is also true that the worker eventually may have to pay more in taxes, indirect or otherwise, as a result of inefficiency at a government-owned plant and its failure to pay the fat share of the total tax burden now paid by privately owned electric companies.

But that does not interfere with the delight with which a pure scientist sees his experiment working out just as he had figured—in one instance. The thing *works!* The cost of making it work is for the moment immaterial—to him.

Let's glance at the municipal plant situation in TVA territory for a moment. PWA loans there, and elsewhere, are now held up by injunction, pending decision by the Supreme Court of a test case—the test to decide whether the federal government, either by outright grants or by loans at low interest, has the right to subsidize local experiments in municipal ownership.

But any one of these communities can go ahead if it is willing to risk not getting federal help, and provided, of course, it has the money with which to proceed. Memphis, one of the larger cities in the territory, is already doing this. It is floating a nine-million-dollar bond issue to finance a municipal plant and has construction under way. TVA started construction of a transmission line. Memphis is counting on getting a PWA grant later—has all sorts of assurances from the White House and from PWA Administrator Ickes—knows that it would be little short of political heresy for the Administration to throw the city down.

Knoxville has a PWA loan, also tied up by injunction, but all reports from that community indicate the public ownership project is merely delayed. Chattanooga is reported strongly in favor of a municipally owned plant.

The town of Sheffield, Ala., has issued a $280,000 bond issue and is negotiating for the purchase of the Alabama Power Company distribution system there. As the two other towns of Florence and Tuscumbia have already got on the municipal electric bandwagon, and as the three towns are virtually a unit so far as the electric situation is concerned, there is little doubt of the eventual outcome.

Some opponents of government ownership take hope because in many instances, since the PWA loans were approved, costs have advanced sharply. They think maybe the various municipalities will not stand the additional cost to their own treasuries. Indications are that few will drop out. Apparently the argument that the original terms are much better than could *now* be obtained from PWA are effective. Under present restrictions, only the cost of labor taken from the relief rolls, plus 15 per cent for administrative costs, can be obtained as a grant. Many of the loans now held up by injunction included 45 per cent outright grants. True, the stipulation was made that labor from relief rolls must be used wherever possible. But this was small potatoes. It was and is easy to get around. Relief roll labor does not lend itself to the electric industry. And by the same token the total of any *new* grant would be smaller.

News OF THE WEEK

Georgia Power Speeds Building Program to Improve Facilities

Construction of 760 miles of rural power lines under way as part of $7,000,000 allocation for new work — Total operating and construction budgets total $21,000,000 — Taxes to total $3,000,000

A program of new construction and improvement of facilities involving approximately $7,000,000 is well under way this year by the Georgia Power Company, the largest budget since 1930, according to Preston S. Arkwright, president. Of this amount, approximately $1,000,000 is being spent in the construction of 760 miles of new rural electric lines and extensions to existing rural lines. This rural line construction, Mr. Arkwright stated, is a continuation of the program of last year in which 930 miles of rural lines were built.

In addition to its own expenditure for rural electrification, Mr. Arkwright said, the company is continuing its policy of co-operation with the Rural Electrification Administration. He pointed out that the R.E.A. has already granted or allocated more than $1,000,000 to build "co-operative" lines in Georgia.

Important additions

In a number of Georgia cities important additions are being made to increase the capacity of substations and transmission and distribution lines. More than $330,000 is being spent in Augusta and vicinity to increase the power supply. More than $100,000 is being expended in Athens to provide for the growing use of electric service. It is estimated that more than $120,000 will be spent in Columbus for new facilities.

In Atlanta alone more than $1,000,000 will be spent to provide additional electric and street railway service and for improvements at Plant Adkinson, the company's 100,000-hp. steam-electric generating plant on the Chattahoochee River.

New substations are to be constructed at Bremen and at Griffin and important improvements will be made at the substation at Thomaston.

Line to be rebuilt

The main transmission line from Atlanta to Macon will be rebuilt at a cost of more than $275,000. Completion of a transmission line from Eastman to Hawkinsville and construction of a new transmission line from Madison to Greensboro will strengthen the company's state-wide network of power lines and give those towns and the surrounding territory additional sources of power, Mr. Arkwright said. Construction work on these two lines will require the expenditure of about $100,000, he stated.

Miscellaneous improvements to service in at least twenty other cities will cost more than $500,000.

Total operating and construction budgets of Georgia Power for this year will be in excess of $21,000,000, Mr. Arkwright stated. Of this amount $7,500,000 will be paid to employees in wages and salaries.

$3,000,000 in taxes

Tax payments to the federal government and to state and local agencies will amount to more than $3,000,000, Mr. Arkwright said. Of this amount tax payments by the county, in compliance with the unemployment and old age provisions of the Social Security Act, will be approximately $225,000. This is in addition to the amount which will be deducted from employees' wages in accordance with the requirements of the law, he said.

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Consolidated Edison Signs with A.F. of L.

Consolidated Edison Company of New York, Inc., announced this week that contracts had been signed with locals of the International Brotherhood of Electrical Workers, an A.F. of L. affiliate, recognizing them as collective bargaining agencies for their members. The contract covers electrical employees in Manhattan and the Bronx. Another has been signed covering gas employees in Manhattan, the Bronx and Queens.

These contracts, like previous ones signed with locals representing employees of affiliated companies in Brooklyn, Queens and Westchester, provide for continuous operations without strikes. All present benefits to employees are being retained. A pay raise of 5 per cent for all employees making less than $5,000 a year is granted to those not having received a like raise since the first of the year. Those who have received a raise get an increase of $1 a week. Employees making less than $40 a week receive an increase of $2 a week.

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Utilities Power & Light Files Amended Bill of Complaint

Last week Utilities Power & Light Corporation filed an amended bill of complaint against Harley L. Clarke raising the amount which it claimed he "fraudulently" obtained from it from $3,000,000 to $5,000,000.

Replying to the complaint, Mr. Clarke stated that "the suit might just

as well have been for fifty millions as five, and it never would have been brought except to divert attention from further attempted liquidation. All these attacks are really inspired and dictated by the Atlas Corporation (alias Floyd B. Odlum), probably the largest and best known liquidating investment trust of modern times."

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Engineer in Pivotal Position, Says Dunn

The nation must turn to the engineer to solve the problems of labor and industry, Gano Dunn, president of Cooper Union, declared in his commencement address at the Massachusetts Institute of Technology last week.

"The engineer now finds himself in a pivotal position in industry, intermediate between capital and labor, with the problems of both of which he deals intimately and is in a position to understand, interpret and judge," Mr. Dunn, who is president of the J. G. White Engineering Corporation, told the graduates.

"Is it too much to hope that with an enlightened method of approach and the habit of factual investigation, which are the intellectual birthright of the engineer, his increasing participation in management may bring to the solution of some of the social problems of industry a prejudice dissolving light? . . ."

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Dallas Power Calls Bonds

Dallas Power & Light Company has called for redemption July 1 series A 6 per cent bonds, due 1949, to the amount of $6,000,000 at 104½, series B 7½ per cent bonds, due 1949, to the amount of $1,100,000 at 106, series C 5 per cent bonds, due 1952, to the amount of $4,500,000 at 103 and $1,000,000 series D 5½ per cent bonds, due 1954, at 102.

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Wins General Electric Poll

The United Electrical and Radio Workers of America, a C.I.O. affiliate, has won a poll conducted by the National Labor Relations Board on sole bargaining rights at an election at the General Electric Bridgeport, Conn., plant. The poll was 2,790 for the C.I.O. union and 1,991 for the General Electric Industrial union.

New York Municipal Plants Told to Reduce Electric Power Rates

Commission discloses heavy excess profits of city utilities in move to bring about sweeping cuts — Returns range from 11 to 141 per cent — Service Board can limit earnings to 6 per cent

New York municipalities which are reaping excess profits from their publicly owned utility plants have been ordered by the Public Service Commission to reduce rates immediately in order to avoid rate reduction proceedings. Disclosing heavy excess profits by the municipal plants, the commission has undertaken for the first time a state-wide reduction in rates in more than a score of communities.

Having successfully brought about substantial cuts in electric rates of the privately owned utilities, the commission believes that a municipal plant should not charge excessive rates so that the heavy profits can be diverted to other activities.

Cites excess profits

The commission listed cities and villages with rate returns ranging from 11 to 141.1 per cent. The commission has power to limit earnings of both public and private plants to 6 per cent.

At the last session of the Legislature Governor Lehman recommended an amendment to the Public Service Law which would authorize the commission to limit rates charged by municipal plants to actual cost of service. The commission indorsed the proposal, but it was defeated.

At hearings held on the proposed law it was brought out that many municipal plants had diverted large sums for various other purposes, thereby burdening ratepayers and customers. The commission contended that this diversion of large profits to other than gas and electricity services was an unfair burden on customers.

It was ruled several months ago by the Court of Appeals that the commission had no power to limit the profits of a municipal plant to bare operating expenses and that a municipal plant had as much right to a fair return as a privately owned plant.

Freeport, which reduced its rates 48.2 per cent last year, was not among the communities ordered to lower rates.

Excess rates of returns and amounts of contributions to municipalities from municipally owned utilities during the year covered by the commission's last annual report are shown in the table.

Cities Listed

Town	Percentage of Excess Rate of Return	Contribution From Plant
Dunkirk	13 8	$152.318
Jamestown	20 0	186.965
Salamanca	11 8	68.000
Akron	45 0	77.665
Angelica	19 3	5,016
Delevan	19 5	3,050
Frankford	21.8	29,071
Endicott	25 2	197,214
Freeport	11.7	99.110
Greene	24 7	8,600
Green Island	141 1	52.369
Greenport	14 6	96,865
Groton	32 0	
Hamilton	28 6	114.918
Herkimer	19 4	86.893
Lake Placid	18.8	249,700
Little Valley		895
Macedon	21 8	10,700
Marathon	19 9	2,755
Mohawk	18 4	18,350
Port Byron	11 3	854
Richmondville	17 9	11,622
Rouses Point	13 6	46,675
Savannah	16.8	17,300
Sherbourne	17 6	30,089
Skaneateles	29 4	75,508
Springville	11 5	71.875
Tupper Lake	34.6	167,534

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C.I.O. Plans Drive in Southern States

Representatives of the United Electrical and Radio Workers of America, C.I.O. affiliate, have announced "an intensive drive to provide C.I.O. organization for employees of the Alabama Power Company and other southern utilities." Offices have been established in Birmingham. Albert Stonkus, director of the utilities division, together with four other organizers, has been in the South for some time surveying the utility situation. In the meantime, Robert Klein has been named general chairman, Cecil E. Lyle, secretary, and W. Howard Williams treasurer of the Alabama Power Company Employees Association. The Employees Association has been sole collective bargaining agency for the past two years, and has negotiated a mutually acceptable contract dealing with wages, hours and seniority rights with the company.

Pennsylvania Commission Moves for Sweeping Utility Rate Cuts

Duquesne Light notified that its rates are too high — Beamish to recommend temporary rates for Madison Power & Light — Driscoll issues warning of attitude of commission

Pennsylvania's new Public Service Commission has taken steps to put into effect the sweeping powers granted it in the new utility regulatory measure passed by the Legislature this year. With authority to impose temporary rates on utilities, pending final determination of rate proceedings, the commission has served notice that sweeping rate reductions must be made by companies.

Duquesne Light Company, Pittsburgh, owned by the Philadelphia Company of the Standard Gas & Electric System, has been notified by the commission that its rates are too high. Hearings have been scheduled. This is the first time that the new powers have been invoked.

Favors temporary rates

Commissioner Richard J. Beamish has served notice on the Madison Power & Light Company of York that he will recommend imposition of new temporary rates and the sliding scale of reduction. The new rates will remain in force until complaints against present rates have been adjusted. June 23 has been set as the date for hearings on the motion by Mr. Beamish. Commission lawyers point out that the company is now making a return of 8.5 per cent. Investigation of the York case has been under way for the past three years. Last March the commission ordered the company to reduce its rates $250,000 a year.

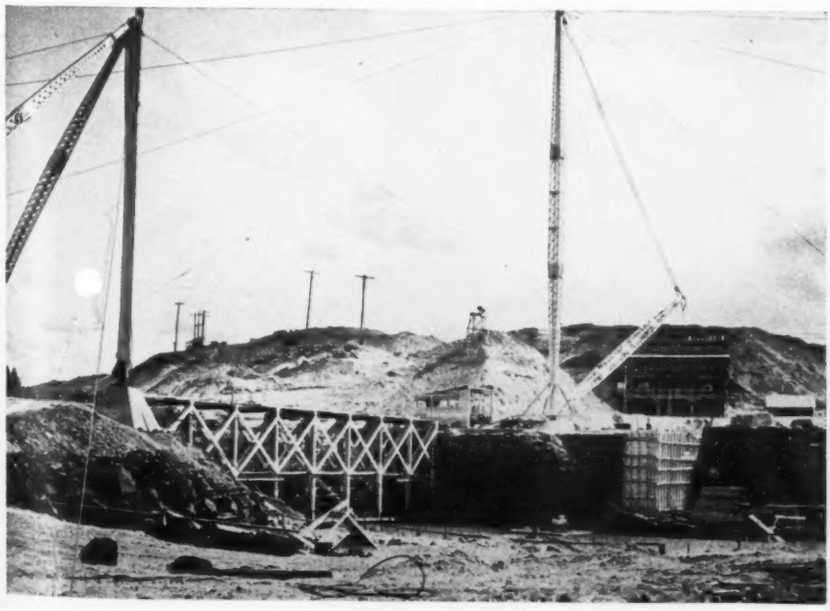
Driscoll issues warning

Former Congressman Dennis J. Driscoll, chairman of the new Pennsylvania commission, said that "this is the first step in a previously announced investigation of utility rates throughout the Commonwealth." He added that this was "a warning for all utility companies and their respective barons to scamper for the cyclone cellar."

It is expected that notification ordering rate reductions will be sent to other utility companies operating in the state.

The new law provides that the commission may impose temporary rates yielding not less than 5 per cent of capital investment until a rate case is finally decided. The company is to be compensated for what it lost if the decision favors it, the ratepayers to be paid the difference if the case favors them. The commission may further establish a sliding scale under which the rates are fixed in accordance with the increase or decrease of revenue. The burden and the cost of justifying present rates rests upon the utility.

Another section of the new utility regulatory law which is expected to be enforced is the one prohibiting customer deposits to insure payment of service bills. Under the old law the companies required a deposit of $5, which the companies held until service was discontinued. Interest at 5 per cent was paid the customer. Should utilities be required to return present deposits millions of dollars will be returned to customers.



NEW HYDRO PLANT—The new Upper Salmon Falls plant of the Idaho Power Company on the Snake River is scheduled for completion in October. The plant will house two 9,000-kva. generators.

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City Board Approves Ruby Dam Plans

Clearing the way for an early start on Seattle's largest construction project, plans and specifications for City Light's projected $4,335,000 Ruby Dam of the Skagit Hydro-Electric project have been formally approved by the Board of Public Works. Plans must now be approved by the Federal Power Commission and the PWA which will provide 15 per cent of the construction cost plus relief labor costs.

Of the $4,335,000 available for the first unit of the dam, 45 per cent is included in a $3,000,000 grant by the PWA for the entire Skagit program, and the remainder will come out of City Light construction bond funds.

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Pacific Gas Rehearing Set

Rehearing on the application of the Pacific Gas & Electric Company for amendment of its license for Project No. 184, located on the South Fork of the American River near Sacramento, Calif., which was originally scheduled to be held in Washington, D. C., on June 15, has been continued by order of the commission and will be held before Commissioner Basil Manly July 19 in Sacramento, to be thence continued in San Francisco upon order of presiding Commissioner Manly. The continuance and change of place were made by the commission at the company's request.

E.E.I. Committee Plans World's Fair Exhibit

Plans for the participation of the electric utility industry in the New York World's Fair of 1939 are well under way by the Edison Electric Institute committee, of which Alfred H. Schoellkopf, president of Niagara Hudson Power, is chairman.

Mr. Schoellkopf stated that the committee has worked out preliminary plans under which the entire central station light and power industry will participate in the exposition. The plans call for the erection and maintenance of an adequate and appropriate exhibit which will demonstrate the multitude of ways in which electricity is used in the home, on the farm and in industry.

The committee is composed of Mr. Schoellkopf, Edward J. Doyle, president of Commonwealth Edison; Louis H. Egan, president of Union Electric Light & Power; Oscar H. Fogg, vice-president of Consolidated Edison Company of New York; H. Hobart Porter, president of American Water Works & Electric; W. H. Taylor, president of Philadelphia Electric, and Wendell L. Willkie, president of Commonwealth & Southern. Clayton Irwin has been appointed as director.

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Stockholders Vote Jersey Merger Plan

Further steps were taken at meetings held in Newark last week in the announced plan to merge various underlying companies into Public Service Electric & Gas Company. Stockholders of the New Brunswick Light, Heat & Power Company voted 3,120 shares out of a total of 4,000 shares outstanding in favor of a merger. No votes were recorded in the negative. A special meeting of the stockholders of Newark Consolidated Gas Company revealed that 29,500 of the 60,000 outstanding shares were represented by proxies, which number, being short of the two-thirds vote required by law for a merger, led to the meeting being adjourned to July 12.

At meetings of the South Jersey Gas, Electric & Traction Company, the Paterson & Passaic Gas & Electric Company and the Gas & Electric Company of Bergen County stockholders of the respective companies voted for mergers and at a subsequent special meeting stockholders of Public Service Electric & Gas Company agreed to the merging of the four companies. Completion of the plan is subject to the approval of the New Jersey Public Utilities Commission and the Federal Power Commission.

Federal Power Commission has approved application by Public Service Electric & Gas for authority to merge the Somerset, Union & Middlesex Lighting Company into the applicant. A merger agreement has been approved by the boards of directors and stockholders.

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Uniform Accounts Adopted

West Virginia Public Service Commission has ordered the adoption of a revised uniform system of accounts of electric utilities operating in the state as recommended by the National Association of Railroad and Utilities Commissioners with certain modifications.

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Kentucky Deal Consummated

Mayor Winn Davis, Glasgow, Ky., handed officials of the Kentucky-West Virginia Utilities Company at Louisville a check for $200,000 and received the deed to the company's water works property at Glasgow. The transaction completed negotiations started last fall when citizens approved a bond issue to provide money to purchase the plant.

Diesel Engine Sales Seen in Low Ratings

Nine out of ten Diesel engines sold in the near future will, in the opinion of L. H. Morrison, editor of *Diesel Power*, fall in the 25 to 100-hp. class. A prediction of 2,000 sales in even smaller ratings in 1937 was made. He made these statements to the Interstate Power Club at an all-day meeting in New York last week in conjunction with a plea to put power-purchase and Diesel competition on a higher plane of selling ethics. Both sides, he feels, are making unsupportable claims of superlative performance and unsupportable accusations of incompetency.

Caution was expressed that utilities would ultimately suffer, as the railroads have, from the rebate evil if they expand their practice of buying up competitive plants. Mr. Morrison admitted that there were hundreds of places where Diesels had been installed without justification. Installations as quiet as motors, self-contained and needing no cooling water, with costs surprisingly low because of volume production, were foreseen. The new crop of Diesel salesmen of higher types will, Mr. Morrison believes, give the utilities keen competition.

Low interest rates and the surplus tax innovation, both of which make industrial capital surpluses almost "free money," are contributors to the

WORLD'S FAIR—Alfred H. Schoellkopf, president of Niagara Hudson Power and chairman of the New York World's Fair Committee of the Edison Electric Institute, and Louis H. Egan, president of Union Electric Light & Power, at the committee's exhibit at the E.E.I. Chicago convention

competitive experience of power salesmen, in the opinion of W. A. F. Pyle of the Delaware Power & Light Company. He advocates raising the query "Will Diesel seller guarantee that all kw.-hr. costs will not exceed the rate available from the utility company?" He disputed Mr. Morrison's assertion that small users are not annoyed by occasional interruptions and, on the basis of A.S.M.E. Diesel cost data, asked how the 25 to 100-hp. plants could beat a 2-cent rate.

H. E. Murphy, General Electric industrial engineer, cited lumber plants, railroad shops, coal mines, macaroni and paper manufacturers who earned from 30 to 138 per cent on money spent for industrial modernization.

Ninety-two from six states were in attendance, a record turnout, and it is planned to hold all-day sessions at all of the 1937-38 series of meetings.

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America to Take Part in Power Discussions

The United States has accepted the invitation of France to participate in the ninth International Conference on High-Tension Electric Systems, which will be held in Paris from June 24 to July 2.

Frederic Atwood, president American National Committee of the international conference, has been named as chairman of the American delegation. E. C. Crittenden, assistant director National Bureau of Standards, Department of Commerce, and Oscar C. Merrill, first vice-chairman of the International Executive Council of the World Power Conference, are the other two members of the American delegation.

The conference, which meets biennially, is devoted mainly to the discussion of the problems of production and transformation of energy, construction and insulation of lines and the development and protection of systems.

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Hydro Hearing Set for July

Federal Power Commission has given notice of a hearing to be held on July 7 on the application of the Gasconade River Power Company for a license to construct, maintain and operate a hydro-electric project on the Gasconade River in Phelps and Pulaski Counties, Missouri.

Electric Safety Code Committee Organized

Sectional group of 22 members to seek revision — Lloyd is chairman and Campbell of E.E.I. secretary

Organization has been effected for the new sectional committee which will move at once to revise the National Electrical Safety Code. Instead of 98 members of two separate sectional committees, the work will proceed this time in a sectional committee of 22 members. They will comprise eight from regulatory authorities or influences, six from utilities (two power, two communication, two transportation), one from employees, two independent experts and technical society representatives, three from insurance, one manufacturers' representative and one contractors' representative.

M. G. Lloyd of the Bureau of Standards is again chairman and A. B. Campbell of E.E.I. the secretary. Organizations which were represented on the former sectional committees will participate through the medium of the subordinate technical committees.

The utility members include: T. H. Haines, Boston Edison (A.I.E.E.); R. M. Godwin, Philadelphia Electric (A.S.S.E.); C. R. Harte, Connecticut Company, (A.T.A.); Sidney Withington, New Haven R. R. (A.A.R.); Walter C. Wagner, Philadelphia Electric Company (A.E.I.C.); W. G. Kelley, Commonwealth Edison Company (E. E.I.); D. P. Dickie, Western Union Telegraph Company, and H. L. Huber, American Telephone & Telegraph Company.

Mr. Campbell suggests that any power company which has not already made arrangements to submit suggestions for changes in the code should send them to him at E.E.I. headquarters in New York City.

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Penn Utility Changes Name

Penn Central Light & Power Company, which serves many communities in central Pennsylvania, has changed its name to Pennsylvania Edison Company. Upon the approval of the proposed merger of Pennsylvania Electric Company and Keystone Public Service Company with Pennsylvania Edison Company, petitions for which were recently filed with the Public Utilities Commission, the territory served will be extended in the western and northern portion of the state. In view of this proposed change in the territory served it was felt that the former name did not properly describe the contemplated enlarged operations of the company.

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New York Completes Plan for Utility Tax

Plans have been completed for administering the new public utility tax, effective July 1, and providing for a 2 per cent state-collected tax on gross income of utilities for unemployment relief, and empowering cities to collect an additional 1 per cent to help meet their unemployment relief burden, according to Mark Graves, New York State Commissioner of Taxation and Finance.

Conferences are being held with utility managements in an attempt to formulate a workable plan of administering the new tax law.

Businesses which fall into taxable group are gas, electricity, steam, water, refrigeration, telephone, telegraph, street surface, subway and elevated railroads (other railroads being exempted), omnibus, express, freight terminal, bridge, baggage and transfer companies. The only stockyard in the state has been classified as a utility and will have to pay. Hotels and apartment houses which sub-meter electricity or similar utility services, or which furnish a central telephone service, all fall within the taxable group under the new law.

The state expects to collect over $24,000,000 a year from the utility tax.

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Power Contracts Under Fire

Recommendation for an "immediate investigation" of service contracts between the Niagara Falls Power Company and the Aluminum Company of America has been made in an opinion by Maurice C. Burritt and indorsed by a four-to-one vote of the commission. Mr. Burritt's opinion asked investigation of contracts for mechanical energy between the two companies. It was also urged that rate schedules which the power company proposed to file, permitting the sale of power to industrial corporations under five-year contracts, be allowed to become effective "if not further substantially changed."

Commission Permits $17,029,000 Offering

Public Service Commission has authorized the Buffalo-Niagara Electric Corporation, formed by consolidation of the Buffalo General Electric Company, the Niagara Electric Service Corporation and the Tonawanda Power Company, to issue not to exceed $17,029,000 of general and refunding mortgage bonds, 3½ per cent, series C, for refunding purposes.

Proceeds will be applied to refund by redemption the following outstanding mortgage bonds:

(a) $7,029,000 of first refunding mortgage 5 per cent gold bonds due on April 1, 1939, of Buffalo General Electric Company, to be redeemed on July 1 at 105 and accrued interest.

(b) $10,000,000 of general and refunding mortgage 5 per cent gold bonds, series A, due on February 1, 1956, of Buffalo General Electric Company, to be redeemed on August 1, at 103 and accrued interest.

The new bonds are to be issued not later than August 1 and are to be secured by the general and refunding mortgage dated February 1, 1926, of the Buffalo General Electric Company, a constituent company.

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Two Utility Systems Pool Facilities

The Northwest Carolina Utilities, Inc., of Blowing Rock, N. C., and the New River Light & Power Company of Boone, N. C., have completed a contract whereby energy generated by the five power plants involved may be used simultaneously. The merger has been approved by the State Utilities Commission. The Northwest Carolina Utilities, Inc., has two power plants, a hydro plant on Wautauga River and a Diesel plant at Blowing Rock, and the New River Light & Power a hydro on New River, a steam unit in Boone and is now installing another large steam unit.

Total capacity of the connected plants will be 1,806 hp. The tie-in line to connect the two systems will be metered and the two companies will buy and sell from each other. Construction of the line has already been started.

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Consumers Strike Settled

Electric washing machines and refrigerators went back into use last week in Toecane, a mountain community in Mitchell County, N. C., after a consumer "strike" ended. For thirty days the Toecane consumers of the Northwest Carolina Utilities had quit using electric energy in protest of what they termed exorbitant rates. The utility company announced a 22 per cent reduction in power rates to the satisfaction of the consumers. Utilities Commissioner Stanley Winborne stated that the rate cut would save consumers in North Carolina $12,000 a year. O. G. Martino of Richmond, Va., vice-president of the company, said that it had lost $20,000 in serving about 1,800 customers in North Carolina last year.

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Fake Stock Sales to TVA Power Customers Revealed

Approximately 400 persons have been swindled out of $8,000 to $10,000 by fake stock salesmen, according to officials of the Joe Wheeler Electric Membership Corporation, Hartselle, Ala. These persons bought nonexistent stock in the corporation, it was said.

A group of Morgan and Lawrence County citizens organized the electric membership corporation a few months ago for distribution of TVA power to rural users and a contract has been made with TVA for construction of power lines.

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Tri-County Project Planned

Plans are being worked out for forming a rural electrification district which will include Curry and Roosevelt counties of New Mexico and the adjoining county of Palmer in Texas. The Texas-New Mexico Utilities Company, which will furnish the power for the proposed system, is co-operating with George J. Long, REA field agent, in promoting the project. Mr. Long said he believed 700 miles of power line could be constructed in the tri-county area.

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Votes Gilbertsville Dam

The House, by a vote of 271 to 61, last week approved the Senate legislation granting the TVA permission to start the proposed $12,000,000 power dam at Gilbertsville, Ky. Representative Taber, Republican of New York, opposed the authorization on the grounds that the TVA "already is producing more electrical power than it can dispose of."

General Electric Gets Order for Six Engines

Six new streamlined electric passenger locomotives, more powerful than any of the 53 now in operation between New York and New Haven, have been ordered by the New Haven Railroad from the General Electric Company. The locomotives will be built at the General Electric plant at Erie, Pa., and have been designed for the hauling of fifteen-car trains weighing as much as 1,200 tons.

The new engines will weigh approximately 430,000 pounds apiece, will have 3,600 hp. and will be capable of a speed of more than 80 miles an hour. Power will be supplied by six motors on as many driving axles, with each motor having two armatures geared to the one axle.

The engines are designed so that power may be drawn either from a third rail supplying 660 volts d.c., or from overhead wires supplying 11,000 volts, 25 cycles a.c., which is then stepped down to suitable operating voltage.

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Disapprove Lighting Park

At a recently called meeting of the Board of Mayor and Aldermen of Pulaski, Tenn., the board disapproved the lighting of the park at night because the town did not care to incur the expense of material and equipment necessary, it did not want to interfere with the status of the park as a children's playground and did not know whether TVA would approve the plan. Pulaski is one of the TVA resale towns.

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Co-operative Asks Franchise

The Greene County Rural Electric Co-operative has applied to the Iowa Railroad Commission for a franchise to build a project at an estimated cost of $300,000 to be obtained from the government on a 20-year loan at 2¾ per cent. Approximately 1,000 farmers have signed. The energy for the project is to be furnished by the Iowa Electric Light & Power Company.

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Funds for Power Dams

Appropriations of $8,706,000 for Fort Peck and $5,000,000 for Bonneville were included in the omnibus bill.

Central Maine Power Buys Two Hydro Sites

Sale of two undeveloped water powers, one on the Androscoggin River and the other on the Kennebec River, has been made to the Central Maine Power Company by System Properties, Inc., a subsidiary of International Hydro-Electric System. Irwin L. Moore, president of International Hydro-Electric, stated that System Properties had received $850,000 in cash, representing proceeds of the sale.

It was pointed out by Mr. Moore that as System Properties is a wholly owned subsidiary and is indebted on open account to the parent company for a substantially larger sum, these funds can properly be regarded as an addition to the available cash resources of International Hydro-Electric System. This payment, added to cash on hand in the system's own treasury at May 31, makes a total of more than $1,900,000.

•

Hits Municipal Competition

A municipality which has granted a franchise to a utility company may not enter upon a competing business, the Kentucky Municipal League has been informed by Guy H. Herdman, Assistant Attorney-General. "A contract is binding on both parties, and it would be manifestly unjust and not in accord with equity to allow one of the parties to an agreement to enter upon a competing venture," he wrote.

•

Ambrose Swasey Dies

Ambrose Swasey, internationally known scientist and chairman of the Warner & Swasey Company, Cleveland, died June 15 at his summer home in Exeter, N. H., at the age of 90. Known as a wizard in the field of precision instruments, Dr. Swasey won many of the honors bestowed by the engineering profession. In 1914 he made the initial gift which established the Engineering Foundation, created for the furtherance of research in science and engineering.

•

Rural Contract Awarded

Contract for construction of 78 miles of rural light and power lines to supply 512 families with electricity in Macon, Trousdale and Sumner counties, Tenn., has been awarded to R. H. Bouligney, Inc., Charlotte, N. C. The Tri-County Electric Membership Corporation at La Fayette is in charge for the three counties. Actual construction will begin at the end of June.

Federal Power Plan Assailed as "Menace"

President Roosevelt can consummate all his objectives by pooling the vast power production of the TVA and other federal power developments, according to Preston S. Arkwright, president of Georgia Power Company.

Speaking before a recent meeting of the Augusta (Ga.) Rotary Club, Mr. Arkwright stated that the only "menace" of the privately owned utility is federal competition.

Attacking the government's subsidized power program, Mr. Arkwright likened the TVA project to Federal General William T. Sherman, saying it has followed closely the route taken by the Union officer in his march from Tennessee into and through Georgia. It is "for the same purpose," Mr. Arkwright said, contending that the TVA encroachment into Georgia is but "a duplication of General Sherman's march."

It was contended by Mr. Arkwright that the $22,500,000 Clarks Hill hydro-electric project is not economically feasible from either a navigation or flood control standpoint. He said that it could be made practicable under the power-pooling system whereby Georgia Power would buy the power and distribute it to customers.

•

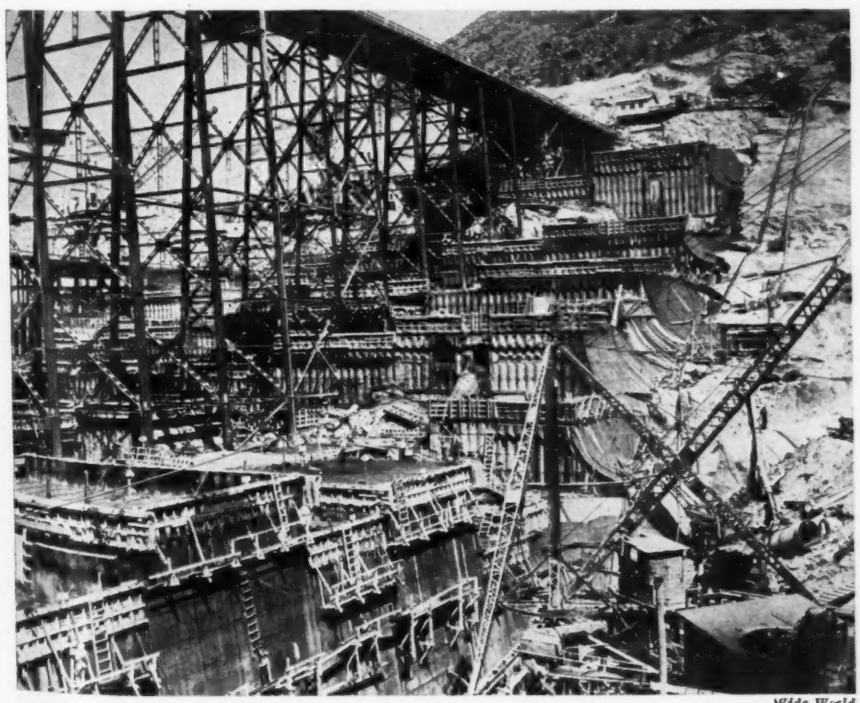
Five-Day Week for Summer

Public Service Corporation of New Jersey has placed its main office in Newark, its commercial office and branches on a five-day week for the summer. This is the first time such a step has been taken and more than 2,000 persons will be affected. The offices will be closed on Saturdays until after Labor Day. A skeleton force will be maintained to take care of emergencies. The new schedule does not affect transport affiliate workers.

•

Cities to Get A.C. Service

Niagara Hudson Power Corporation will construct a new transmission line from Central Square to Fulton, N. Y., a distance of 12 miles, which will provide alternating current for the cities of Oswego and Fulton, according to General Manager Roy W. Porter of the Peoples Gas & Electric Company, Oswego. A new transmission substation will be built at Volney.



Wide World

GRAND COULEE—Progress on the gigantic federal hydro-electric project is being speeded with concrete being poured by day and night shifts. Blocks of concrete and steel are rising to form a 150-mile lake back of dam on the Columbia River

Officers Nominated by Testing Society

Nominations for officers of the American Society for Testing Materials for 1937–38 have been announced as follows: President, A. E. White, University of Michigan, Ann Arbor; vice-president, H. H. Morgan, Robert W. Hunt Company, Chicago. Members of executive committee, P. H. Bates, National Bureau of Standards, Washington, D. C.; H. F. Clemmer, Engineer of Materials, District of Columbia, Washington, D. C.; G. E. F. Lundell, National Bureau of Standards, Washington, D. C.; H. C. Mougey, General Motors Corporation, Detroit, and R. L. Templin, Aluminum Company of America, New Kensington, Pa. Official notice of election will be given at the first session on June 28 of the fortieth A.S.T.M. annual meeting in New York City.

W. H. Swanger and G. F. Wohlgemuth, both of the National Bureau of Standards, have been chosen as winners of the Charles B. Dudley Medal for 1937. This medal is awarded to the author or authors of the paper presented at the preceding annual meeting which is of outstanding merit and constitutes an original contribution on research in engineering materials. The award will be made on June 30 during the annual meeting.

•

Niagara Falls Power Hearing Postponed by Federal Body

The Federal Power Commission has announced indefinite postponement of June 15 and 17 hearings on an application of Niagara Falls Power Company for amendment of its license to authorize diversion of 275 cu.ft. per second additional water.

Hearings scheduled on an objection of the New York State Attorney-General on behalf of the Water Power and Control Commission to the intervention of the New York State Power Authority was continued to a date to be fixed by the commission on ten days' notice.

•

A.I.E.E. to Open Summer Meeting in Milwaukee

A large delegation is being expected at the summer convention of the American Institute of Electrical Engineers during June 21-25 at Milwaukee. An elaborate program of interesting discussions has been arranged. General Otto H. Falk, honorary chairman, will deliver the address of welcome.

Some of the major discussions to take place include power transmission, general power applications, instruments and measurements, education, lightning protective equipment, power generation and electrical machinery, illumination, conference on electrical apparatus for three-phase arc furnaces, insulation co-ordination, vibration and balance and communication and research.

Meetings

Economic Conference for Engineers—Seventh annual meeting. Stevens Institute of Technology Engineering Camp, Johnsonburg, N. J., June 18-26.

Canadian Electrical Association—Annual convention, Banff Springs Hotel, Banff, Alberta, June 21-24. B. C. Fairchild, secretary, 804 Tramways Bldg., Montreal, Quebec.

American Institute of Electrical Engineers—Summer convention, Milwaukee, Wis., June 21-25; Pacific Coast convention, Spokane, Wash., August 30-September 3. H. H. Henline, national secretary, 33 West 39th St., New York, N. Y.

National Association of Credit Men—Annual convention. Hotel Stevens, Chicago, Ill., June 21-25.

Public Utilities Advertising Association—Annual convention, Hotel Pennsylvania, New York, June 22. T. H. Spain, chairman, Public Service Corporation. Newark, N. J.

American Society for Testing Materials—Annual meeting, Waldorf-Astoria Hotel, New York, N. Y. June 28-July 2. R. E. Hess, assistant secretary, 260 South Broad St., Philadelphia, Pa.

International Association of Electrical Inspectors—Joint annual meeting, northwestern and southwestern sections, Hotel Utah, Salt Lake City, August 23-26, F. D. Weber, secretary-treasurer, northwestern section, P.O. Box 70, Portland, Ore. H. L. Gerber, secretary-treasurer, southwestern section, 914 Merchants Exchange Building, San Francisco, Cal. Eastern section, Hartford, Conn., September 27-30, Joseph P. Rohan, general chairman, Hartford Building Department, Hartford, Conn.

Illuminating Engineering Society—Annual convention, Greenbrier Hotel, White Sulphur Springs, W. Va., September 27-30. A. D. Cameron, general secretary, 51 Madison Avenue, New York, N. Y.

Iron and Steel Exposition—Sponsored by the Association of Iron and Steel Engineers, Stevens Hotel, Chicago, Ill., September 28-October 1. Brent Wiley, managing director, Empire Building, Pittsburgh, Pa.

Indiana Electric Association — Annual meeting, French Lick Springs, Ind., September 30-October 2.

Bliss Again Heads New England Society

Frederick W. Bliss, district manager of sales development of General Electric Company, Boston, was re-elected president of the Engineering Societies of New England at the annual meeting last week. Holcombe J. Brown, consulting engineer, Boston, and Leon F. Jackson, Linde Air Products Company, Boston, were elected vice-presidents. Joseph Peterson of the Massachusetts Department of Public Works was made treasurer and Harold C. Hamilton, superintendent of Boston Edison's department of standardization and testing, was elected secretary.

Executive committee members-at-large include Prof. James Holt of the Massachusetts Institute of Technology, Prof. Albert Haertlein of the Harvard Graduate School of Engineering, George A. Montague of the state Department of Public Works and Chester A. Corney, assistant superintendent of the electrical engineering department, Boston Edison Company.

•

General Electric Holds Conference on Lighting

More than 130 home lighting women —directors, supervisors and experienced advisers of utility companies— attended the four-day annual advanced conference on home lighting developments and activities at the General Electric Institute, Nela Park, last week.

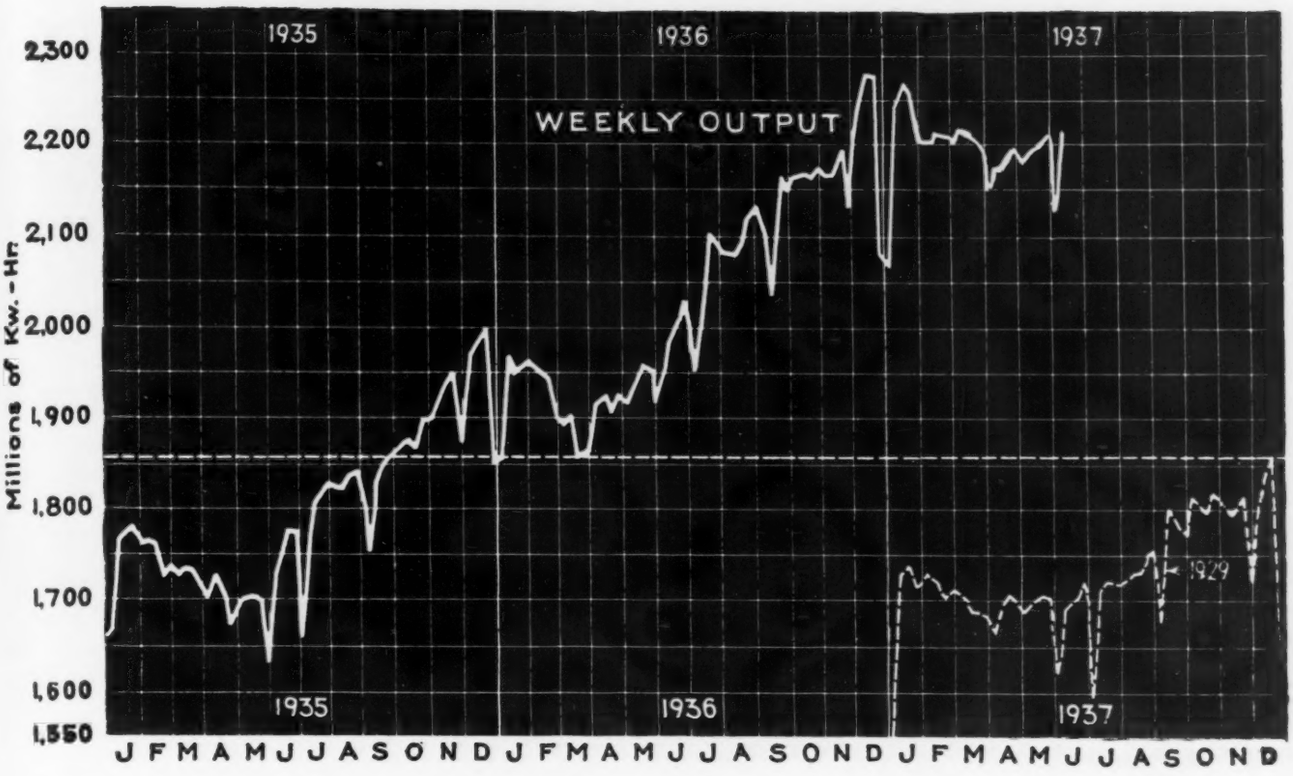
Problems of supervision and department organization were discussed. The various phases of lighting practice were also topics of major interest. E. D. Stryker, Helen McKinley, Mary Webber and E. W. Commery of the incandescent lamp department served as chairman at the meetings.

•

Hold Advertising Meeting

A symposium on the use of the demonstration home in public utility promotion and addresses covering various phases of utility advertising and sales will feature the annual meeting of the Public Utilities Advertising Association to be held June 22 at the Hotel Pennsylvania, New York City. The meeting will be held in conjunction with the 33d annual meeting of the Advertising Federation of America on June 20–23.

Output Highest Since January



Notwithstanding strikes and turmoil the energy output of the electric light and power industry during the week ended June 12 rose to its highest value since the end of January, amounting to 2,214,166,000 kw.-hr., according to the Edison Electric Institute. The gain of 13.8 per cent over the like week of 1936 was the largest since April 24. This latest figure marks a continuation of the gently rising trend of the past two months, but progress is distinctly slower than it was a year ago.

Gains over 1936 continue largest in the Rocky Mountain region. They are increasing in the Pacific, shrinking in New England and the West Central, steady in the Middle Atlantic, but in the Central industrial dropped since March from 24 to 13 per cent.

Weekly Output, Millions of Kw.-Hr.

1937	1936	1935
June 12...2,214	June 6..1,945	June 8..1,724
June 5...2,131	May 30..1,922	June 1..1,629
May 29...2,207	May 23..1,955	May 25..1,696
May 22...2,199	May 16..1,962	May 18..1,700
May 15...2,195	May 9..1,948	May 11..1,702
May 8...2,176	May 2..1,929	May 4..1,698

Per Cent Change from Previous Year

Region	Week Ending June 12	June 5	May 29
New England.....	+ 9.2	+ 5.4	+14.1
Middle Atlantic.....	+13.4	+10.8	+14.2
Central Industrial...	+12.9	+10.3	+14.9
West Central.....	+ 4.4	+ 6.8	+ 6.9
Southern States.....	+13.8	+19.3	+16.8
Rocky Mountain....	+27.9	+27.4	+21.2
Pacific.....	+ 9.1	+ 7.5	+ 6.6
United States.....	+13.8	+10.9	+12.9

April Output in Canada

Electrical output in Canada in April totaled 2,322,884,000 kw.-hr., 7.3 per cent above April, 1936, the Dominion Bureau of Statistics reports. The total for the first four months of the year was 9,199,627,000 kw.-hr., against 8,329,743,000 in the similar period of 1936. Exports to the United States in April amounted to 164,247,000 kw.-hr., compared with 125,496,000 kw.-hr. last year.

•

Italian Superpower Interest

Italian Superpower Corporation will meet the July 1 interest on its $10,504,000 outstanding 6 per cent bonds, Floyd B. Odlum, president of Atlas Corporation, declared last week on his arrival from Europe. However, interest payment due January 1, 1938, is not likely to be met because of exchange restrictions, as there will be no American funds available after the July interest payment.

•

Signs Power Contract

Wilcox-Crittendon Company, Middletown, Conn., which has been generating its power requirements from Diesel installations, has closed a five-year power contract with the Connecticut Power Company. Failure of one of the engines last January brought to light many problems of the power requirements of the company. This led to negotiations for power from the utility.

Detroit Edison Pays Extra

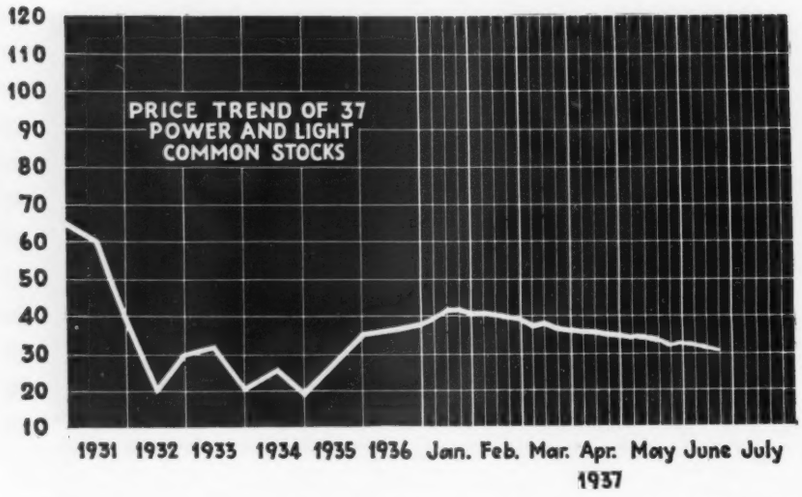
Detroit Edison Company has declared a dividend of $2 a share on the capital stock, payable July 15 to stock of record June 25. A quarterly payment of $1 a share was made on April 15. On July 15, 1936, the company made a $1 quarterly and $1 extra disbursement.

•

Plant to Double Capacity

Contracts on equipment, amounting to $67,628, that will more than double the capacity of the municipal light plant at Pella, Iowa, have been awarded. One contract, amounting to $33,500, was awarded to the Elliott Company, Pittsburgh, Pa., for a 1,000-kw. turbo-generator.

Utility Stocks Continue Lower



Utility stocks continued on their downward trend the past week. "Electrical World" index, 30.8; previous week, 31.8; year ago, 36.7; 1937 high, 41.5

Preferred Committee Hits Standard Plan

Protective committee for holders of Standard Gas & Electric Company $4 cumulative preferred stock, in a letter to holders, opposes the amended plan of reorganization filed in the United States District Court in Delaware on the ground that it betters the position of all other classes of securities.

The proposed plan, according to the committee, compels holders to give up rights to cumulative dividends and to accept in exchange the new convertible second preferred stock, which is entitled to non-cumulative dividends of $2 a share and which is convertible and callable, plus one and one-half shares of common stock.

Such treatment, the committee holds, is without justification in view of the greatly improved earning position of the company since the filing with SEC of the original plan, which provided "merely for the extension of maturing notes and left undisturbed the rights of the $4 preferred stock."

•

Proposes Bond Sale

Iowa Public Service Company has filed a declaration with the SEC proposing to sell at par $1,000,000 of its 5 per cent first mortgage bonds, due 1957, to the Equitable Life Assurance Society of the United States. The bonds are to be purchased for investment. The proceeds will be used to construct property additions at Waterloo, Iowa, and in other additions. A public hearing will be held June 28.

•

Dividend Payments Declared

Among the electric light and power companies that have recently made dividend announcements are the following:

Missouri Edison Company, $1.75 a share against accumulations on the $7 preferred stock.

Lexington Utilities Company, quarterly dividend of $1.62½ a share, plus 50 cents against accumulations, has been voted on the preferred stock.

•

Vote Capitalization Change

Stockholders of the Century Electric Company have authorized changing the $100-par value capital stock to $10-par and increasing the outstanding shares from 45,318 to 453,180.

•

Aluminum Declares Dividend

Aluminum Company of America has declared a dividend of $2.25 against arrears on the preferred stock, leaving accumulations of $6.75 a share. On January 1 and April 1 dividends of $1.50 were distributed.

•

Call Special Meeting

A special meeting of stockholders of Consolidated Edison has been called for July 7, at which time they will vote on the proposals for the company to guarantee the Westchester Lighting Company bond issue and for the company to engage directly in the steam business when the New York Steam Corporation is merged into the parent company.

•

Consolidated Edison Files New Stock Plan

A revised offer has been made by Consolidated Edison Company of New York, Inc., to exchange one of its 5 per cent preferred shares for one $7 preferred share of New York Steam Corporation and nine-tenth share of Edison 5 per cent for one share of $6 New York Steam Preferred. Last week the Utility Commission denied the original offer.

When the denial was made public on June 9 New York Steam $7 preferred broke 30½ points, but closed 79¾, off 23¾ points on the day. The $6 preferred was off 28¾ points on the opening at 66, but closed at 71, off 23⅜ points.

During the latter part of May the $7 preferred sold at 111¼ but broke to a low of 85 when dividends were omitted on June 1 at the directors' meeting. It later rallied to 103½. The $6 preferred was selling at 101, broke to a low of 75½ and then rallied to 94¾.

The commission stated that "a consideration of all the facts with respect to property values, earnings past and prospective, and relative values as recorded by market transactions indicates that the proposed consideration of the Steam Corporation preferred stock exceeds the reasonable value of the stock to be acquired."

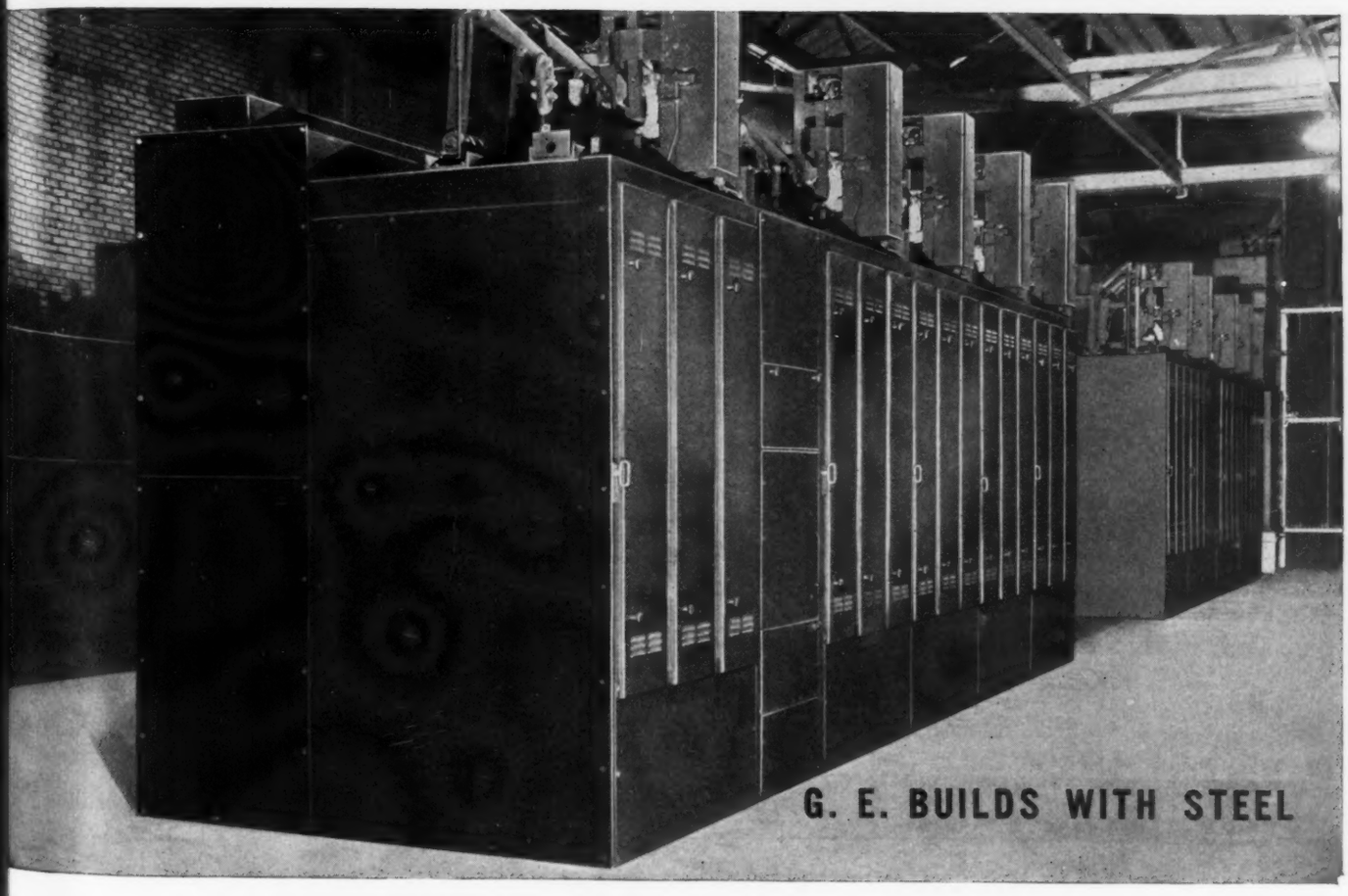
Earnings Reports (Utilities)

	Net Income 1937	1936
Elec. Pwr. & Lt. and subs.	$8,993,929	$3,824,646†
Nat. Pwr. & Lt. and subs.	7,665,668	6,365,812†
Duquesne Light	10,706,743	10,422,453†
Okla. Gas & Elec.	2,547,134	1,885,785†
Philadelphia Co. and subs.	8,826,117	8,465,578†§
Central G. & E. and subs.	1,393,556	264,222*
Assoc. Elec. and subs.	1,381,059	931,922*
Assoc. Gas & Elec. and subs.	36,348,448	33,810,386†‡
Penn. Pwr. & Lt.	4,083,289	4,359,172†
The Montana Pwr. and subs.	2,747,350	1,752,282†
Carolina Pwr. & Lt.	1,111,158	419,765†

* Twelve months ended March 31.
† Twelve months ended April 30.
§ Does not include Beaver Valley Traction and sub.
‡ Operating Income (Preliminary).

Difference!

IN INSTALLATION COST
IN REAL SAFETY - - - - -
with Shipped-Assembled FH Cubicles



Complete Cubicle Equipments Include

Modern FH- Oil-blast Circuit Breakers
Group-operated Disconnecting Switches
Bus and Primary Connections
Tamperproof Mechanical Interlocks
Current and Potential Transformers
Phases Segregated with Grounded Steel

890-32

ELECTRIC

Field OPERATING PRACTICES

New ideas and practices in the operation of well-designed, constructed and maintained plants and systems

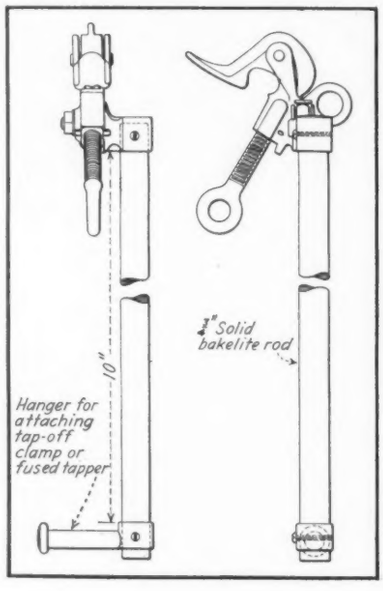
Fuse-Hanger Device Reduces Hazards

Additional insulation for protection of linemen engaged in connecting or disconnecting rural distribution transformers having primary leads that terminate in fused tap-clamps attached directly to line conductors has been provided by one utility operating company which has adopted a special "safety fuse hanger." This device, which is illustrated, consists of a hot line clamp attached to the upper end of a ¾ x 10-in. solid bakelite rod to the lower end of which is attached a metal stud or hanger. It is made by Tips Tool Company.

With this device installed on the conductor to be tapped the fused tie-clamp attached to one transformer lead can be hung from it while the other transformer lead is being connected to the energized line. In this way the "free" transformer lead, which is at or near line potential when the second transformer lead is connected to the line, will be suspended away from the working area where the lineman might come in contact with it.

Instructions for connecting transformers using this device as taken from the operating company's specifications follow:

1. Attach the fuse taps to the primary leads of the transformer. With the clamp stick attach the safety fuse hanger securely to one phase of the line to be connected. In case of 6,900/11,940 Y voltage lines, the safety fuse hanger must be placed on the phase wire and not on the neutral. Be sure the screw eye on the hot line clamp is facing toward the pole. The safety fuse hanger should be placed not less than 24 in. away from the insulator on the transformer side of the crossarm and beyond the permanent tap fuse location.

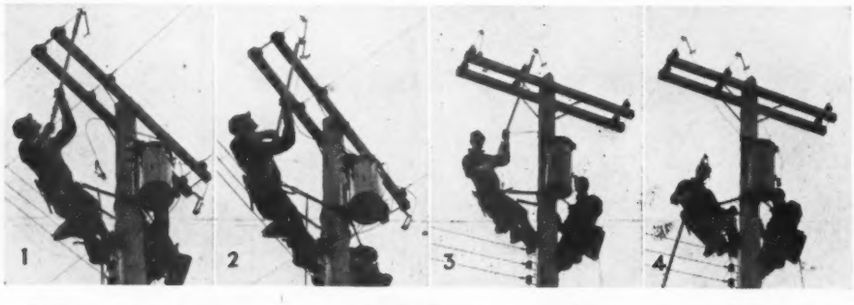


2. Then with the clamp stick hang the fuse tap on the stud of the safety fuse hanger and clamp in place.

3. With the clamp stick hang the second fuse tap in the permanent location on the line and clamp in place. The permanent location of fuse taps is at a point not less than 14 in. from the insulator on the transformer side of the crossarm.

4. Next with the clamp stick loosen and lift the fuse tap off of the stud on the safety fuse hanger and clamp it on the line wire between the line insulator and the safety fuse hanger at a distance of not less than 14 in. from the insulator on the transformer side of the crossarm. Then with the clamp stick remove the safety fuse hanger from the line, which completes connecting the transformer.

Instruction for disconnecting transformers and replacing fuses with this device are similar, but specify that the fuse tap be removed from the conductor to the safety fuse hanger before the second primary lead is removed from its line conductor.



Safety fuse hanger makes rural distribution transformer connection safer for lineman

Numbers on the pictures refer to instructions given in body of the text

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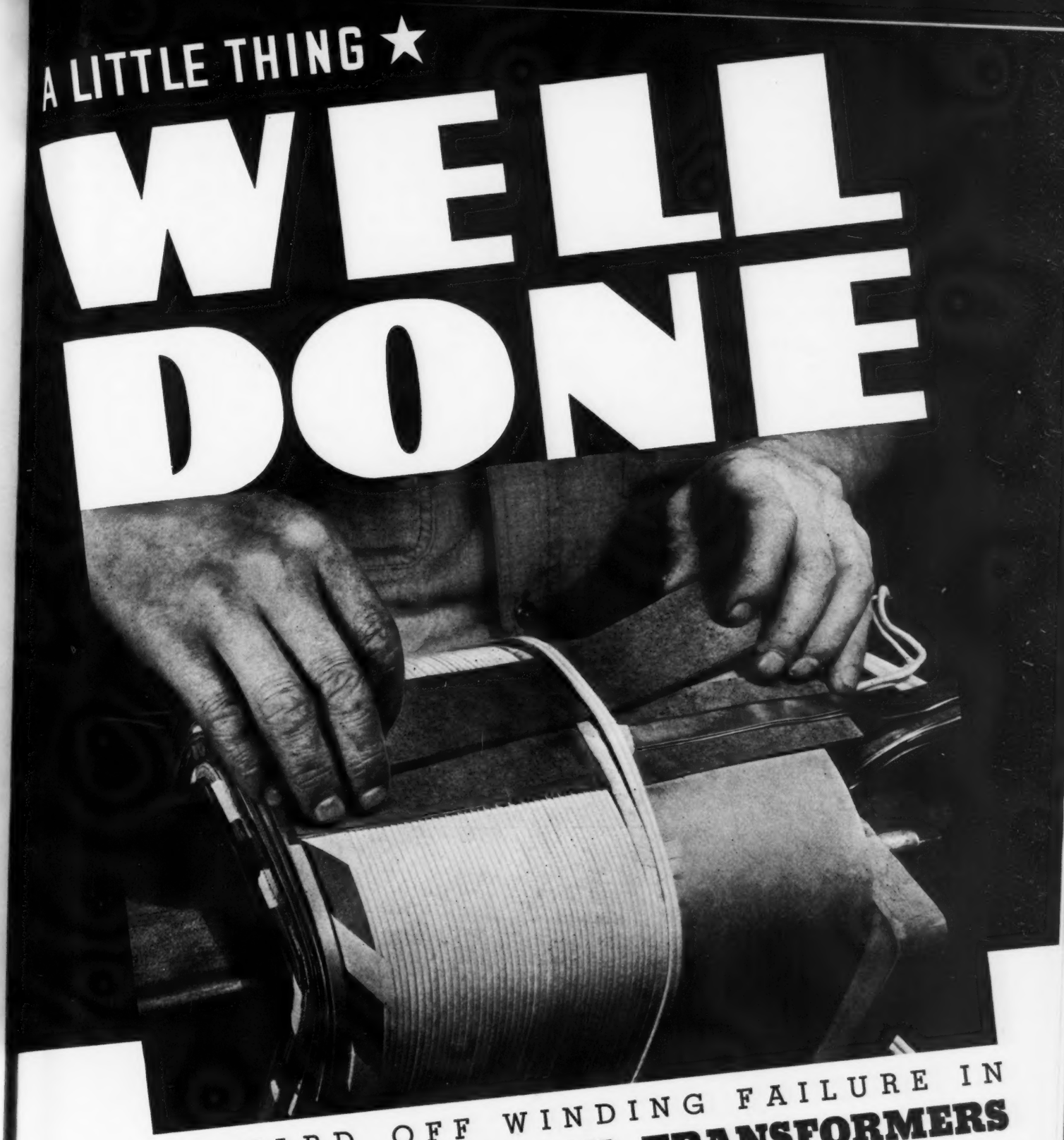
Padlocking Scheme for Sidewalk Gratings

For locking double side-hinged sidewalk gratings over ventilator or manhole openings into transformer vaults it is usual practice to drill a pair of companion holes through the adjacent center bars and then figure out some way to get the thing padlocked so the lock won't be up on top for people to stumble over. In any variant of this method it does not take long for the padlock to get full of dirt, to the disgust of the trouble man who wants to get into the vault in a hurry. But this kind of annoyance is obviated by the grating locks used by the Northern States Power Company in Minneapolis.

As appears in the accompanying sketch, a section of the next to-center-edge bar of one side of the grating

A LITTLE THING ★

WELL DONE

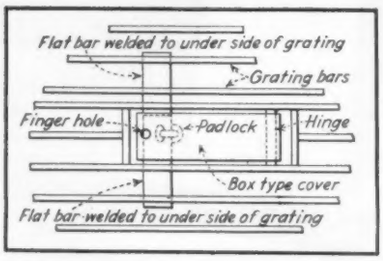


TO WARD OFF WINDING FAILURE IN

L-M DISTRIBUTION TRANSFORMERS

L-M Coil Winders place double layers of insulation both above and below transformer tap leads. The result is more resistance to lightning surges, less danger of winding failure. This is one of the many "little things well done" to make sure that L-M Transformers will give you extra years of trouble-free service. Get full details. Write to South Milwaukee, Wisconsin, for L-M Transformer Bulletin, LMB 6364.

LINE MATERIAL CO.



Locking scheme for gratings keeps padlocks clean

is cut out and crosspieces welded in to form a rectangular opening about 8 in. long. Flat bars are transversely welded to the under edges of the center bars and project beyond them in such fashion that when the grating is closed the projecting ends overlap and by means of coincident holes through them can be padlocked together. The rectangular opening, which allows easy access to the padlock, is normally closed over by an open-bottom cover which is hinged over a welded-in cross bar so that the cover may be easily raised by means of the finger hole. By this means the padlock is made easily accessible and is protected as well.

•

Field Calculations Eliminate Up-Pull

By STUART D. LONG
Civil Engineer Consumers Power Company
Grand Rapids, Mich.

One of the major problems in rural line location is encountered when three poles are to be located at considerably different elevations and when the middle pole is lower than the two other poles. Under these conditions the middle pole should be of sufficient height to avoid up-pull at this point. A method of field solution to the problem has been used by the author for some time with excellent results.

The solution is based on the idea of sagging-in one long span between two outside poles and finding the height of pole necessary to reach the wire at the point of the middle pole under conditions of no loading at 0 deg. F. Considering the span in the accompanying diagram (A) the following relation exists:

$$L_b = \frac{L}{2} + \frac{h\,P_h}{\omega\,L}$$

This formula may be solved without the use of trigonometry tables for although $L' = \frac{L}{\cos\theta}$ it may also be expressed $L' = L + \frac{h^2}{2L}$ when h is small compared to L.

Since most specifications for rural construction call for a constant value of P_h at a given temperature during stringing, regardless of span length, a series of curves solving L_b for various values of span and elevation differences (L and h) may be drawn. A family of these equivalent span curves is shown in the accompanying chart, which was computed for No. 4 ACSR at 0 deg. F. under no loading. The tension at this temperature was 360 lb.

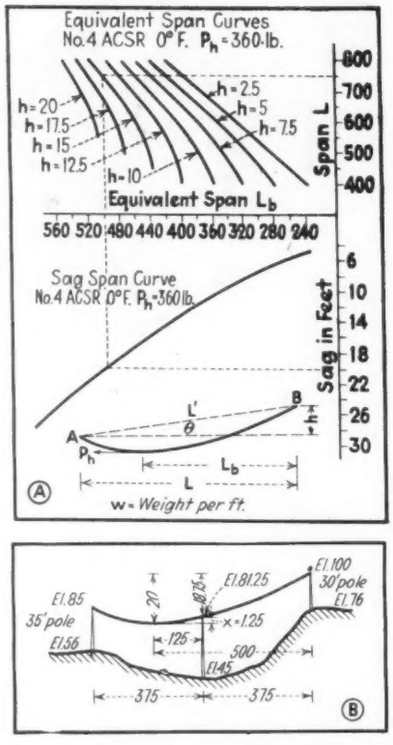


Chart facilitates field calculation of pole height to avoid up-pull

Chart should be used as the following example indicates. Assume conditions shown in diagram (B). Span 750 ft. Difference in elevation of end pole tops 15 ft. From curve L_b is 500 ft., sag at low point 20 ft. By parabolic ratio elevation or sag at midpoint may be found $125^2 : 500^2 :: \times : 20$. X is 1.25 ft. X is the distance the wire rises from low point to middle pole location. Sag at this point is 18.75 ft. (20—1.25). Wire elevation is 81.25. The pole must be 36.25 ft. above ground, therefore calling for a 45-ft. pole to avoid up-pull during stringing and until final sag occurs.

Knowing the span and the elevation difference, position of the low point of the span may be determined by entering the curves. With a sag-span curve drawn from L_b values at similar conditions of temperature and loading, the sag at the low point of the conductor may be found. Sag at any other point along the wire may be found, as surveyors say, by making use of the fact that "offsets from tangent vary as the square of their differences."

In order to avoid placing extra height that would not be used after the final sag has taken place, the equivalent and sag-span curves may be computed for final sag and stress conditions.

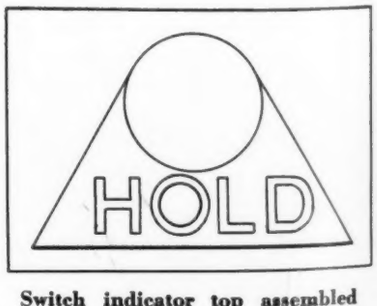
•

Glove Fasteners Show Switch Positions

Many and various, and sometimes quite complicated and expensive, are the devices that have been thought up by ingenious people to indicate switch positions and conditions on the system operating board. One of the simplest, least costly and, according to the testimony of the operator on duty, most satisfactory that has been seen by the traveling editor in a long time is that on the system board of the Oklahoma Gas & Electric Company.

The board is of the familiar type, a single line diagram of the system on black-surfaced Masonite "Prest Wood," assembled on a supporting frame. At each point indicating a switch location there is a stud whose head is the inside part of an ordinary glove fastener. Snapped on these heads are celluloid-covered tops whose different colors and designs indicate the switch positions. A red cap shows a closed switch and a green an open one. A red or green cap with a white center indicates that some special condition applies to the particular switch and it should not be changed from its existing position without checking.

The studs and stops are standard commercial products and can be readily obtained. A nail type stud is used because it is slimmer than the screw type and is not so likely to split the wood panel. The tops are bought in two parts, sockets and celluloid caps separate, and are assembled with a capping die. This allows

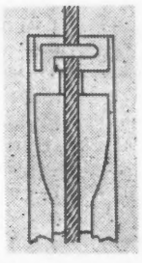


Switch indicator top assembled with leather tab

Convenience...

FOR THE MAN WHO INSTALLS THEM

STAZ-RITE GUY GUARDS



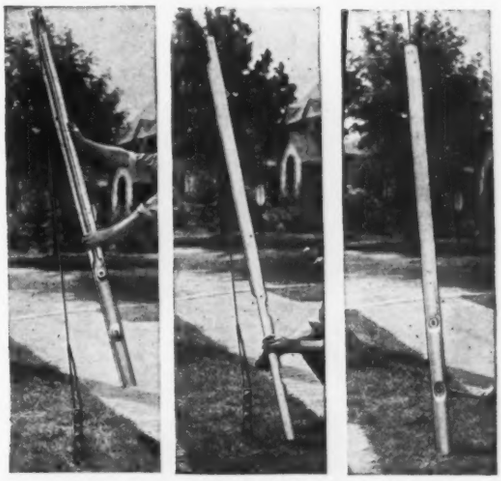
Welded retainer specially designed to permit easy positioning on strand.

The natural appeal of the all around conveniences and simplicity of STAZ-RITE Guy Guards has made them the most popular guard in the country. Only 1 piece to handle (no parts to lose)—easy to install—furnished in full round and half round styles. Investigate their additional exclusive features and

BUILD RIGHT WITH *STAZ-RITE*

The character illustration, "Knight of the Spur," is from an etching by O. Van Rye, District Engineer, Southern District, New England Power Association.

3 Simple Operations Complete the Installation



1. Placing guard on strand. Welded retainer at top of guard forms a secure attachment. 2. Attaching guard to guy clamp bolt. (Depressions permit attachment to either head or nut end of bolt.) 3. Guard securely attached. Lineman's wrench only tool necessary to complete the installation.

UTILITIES SERVICE CO.

ALLENTOWN PENNA.

some of the tops to be made up with leather tabs, as shown in the sketch, to indicate a "hold" or other special order.

•

Instructions for Plowed-in Cable

Buried armored cables are continually more popular and there are some important underground street lighting systems consisting entirely of buried cable without any ducts. The plow has also assumed an important rôle in the laying of underground cable and will no doubt be even more popular in the future. The following instructions of the Detroit Edison Company should therefore be of great interest:

Buried Cable

Use—Buried cable may be used in locations, where, due to lack of proper drainage or other difficulties, it is impossible or impracticable to install conduit, and in some cases for service cables across customer's property.

Ordinarily, armored cable shall be used for buried cable, but in certain cases, when specially ordered, ordinary lead-covered cable without armor may be used. When lead-covered cable is so used it shall be painted with a thin priming solution with a bitumen base and a finish coat of an enamel with a bitumen base, applied hot by the sling method.

Trench—The line of the trench shall be as straight as practicable. Angles and curves shall have a radius of not less than 3 ft. The trench shall be ordinarily 16 in. wide for one cable and 3 ft. deep (except for street-lighting cable between lamps in parkways, etc.) unless greater depth is necessary to pass obstructions, enter manholes, or buildings, etc. In such cases the change in level shall preferably be made over sufficient distance to give an easy grade and in any case to avoid the necessity of sharp bends in the cable (less than 20 in. radius). For street-lighting cable between lamps in parkways, etc., 12 in. in depth shall be used and the trench shall be as narrow as practicable. The bottom of the trench shall be approximately smooth and even and of firm earth, tamped if necessary, to provide a solid support for the cable.

When passing under pavements, sidewalks, paved driveways, etc., iron pipe shall be installed of a size large enough to allow the cable to be pulled through easily (2 in. for small cables and 4 in. for others.)

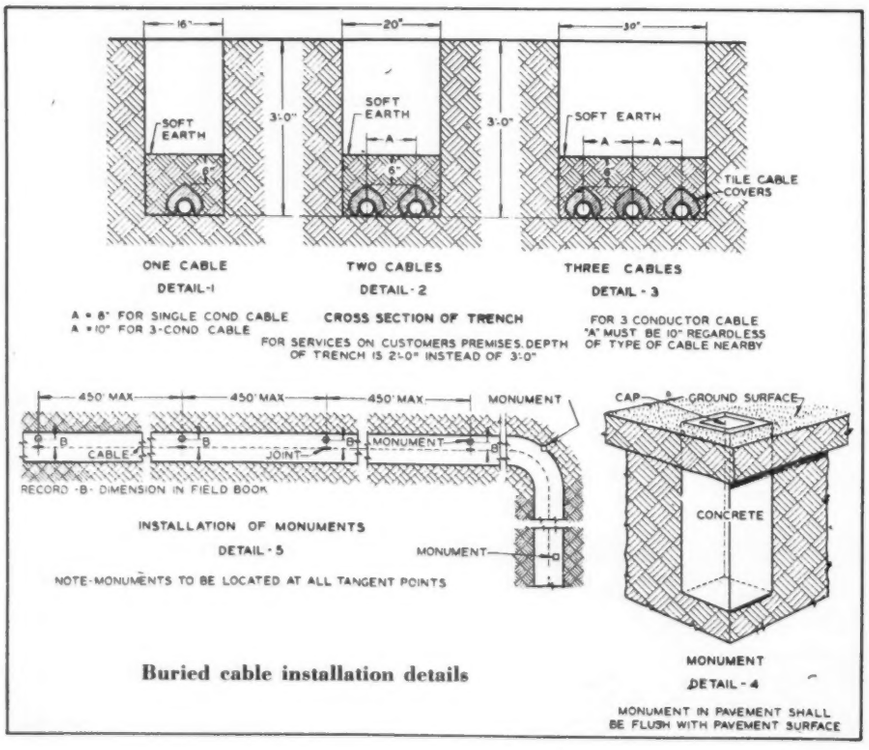
Where two or three cables are to be installed in the same trench, the width shall be sufficient to allow the cables to be spaced as shown in table.

Pulling In—The cable may be installed by unreeling along the trench or by pulling in, as most convenient. The precautions against damaging the cable, as to kinks or bends, speed of pulling, use of grip, etc., for conduit installation shall be observed in so far as they apply to the installation of buried cable.

Where two or more cables are installed in the same trench they shall be spaced as shown in the illustration.

Tagging—Buried street-lighting cables shall be tagged at lamps where the cable changes direction (corners) and any other location where any confusion between cables might result if tags were omitted.

Backfilling—Vitrified tile cable covers shall be laid directly over the cable for its entire length, a larger cover being used to cover the joints. Soft soil, screened if necessary, shall be used for filling the trench up to about 6 in. above the top of the covers. The remainder of the trench shall be filled with ordinary earth.



Buried cable installation details

Ploughed Cable

Use—Street-lighting cable between lamps in parkways, etc., where conditions are such as to make this method feasible may be installed by ploughing in; *i.e.*, pulling in behind the special plough which breaks the earth ahead of it. Armored cable only shall be used for such installations.

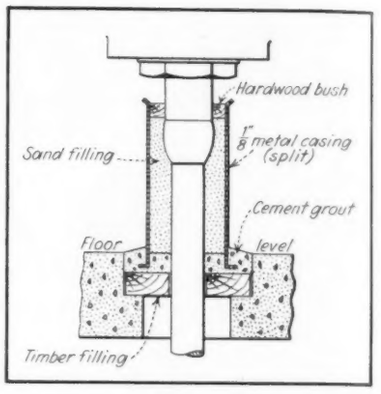
Pulling In—The cable shall run in as straight lines as possible with the minimum number of bends. Such bends shall have a radius of not less than 12 in. The cable shall be not less than 12 in. below the ground surface. No sections longer than 250 ft. shall be pulled in with the plough. Standard cable grips shall be used to hold the end of the cable in pulling in.

When two (or more) cables are run parallel they should not be less than 2 ft. apart when ploughed in. When two cables are installed in a trench they shall be not less than 10 in. apart. If more than two cables are installed in a trench they shall be not less than 6 in. apart.

When running under a pavement, sidewalk, paved driveway, etc., 2-in. or 4-in. iron pipe shall be installed and the cable run through it.

Fire Sealing Scheme for Power Cables

Sectionalizing separate cable chambers in the same way as main switchgear is among the fire precautions to be considered in the design of power stations, according to a paper presented by F. C. Winfield before the British I.E.E. Fires in cable chambers usually start elsewhere and are communicated through imperfect sealing. To supplement sectionalizing of cable chambers the author suggests complete fire division between switch and cable chambers by sealing holes in floors, cable exits, etc. A suggested method is shown in the accompanying illustration. Where single cables leave a chamber horizontally through walls and where groups of cables have a chamber in a trench a simple sealing is to fill the trench or a portion of it with sand or gravel.



Sealing for cables passing through floors prevents spread of station fire

New ENGINEERING IDEAS

Discoveries, proposals and developments by electrical engineers and scientists in the field, the factory and the laboratory

Paralleling Method Eliminates Equalizer

By L. W. THOMPSON and E. E. JOHNSON

Regulator Engineering Department, General Electric Company, Schenectady, N. Y.

An arrangement making it possible to operate two or more direct-current generators in parallel with or without equalizer buses, regardless of size, speed fluctuations and load-voltage characteristics, has recently been put in operation. Accurate control of voltage and division of current is secured with this scheme at all loads and speeds at which each generator is capable of maintaining normal voltage at maximum load and minimum speed.

This operation is obtained by controlling each machine with a voltage regulator of the direct-acting type; that is, one in which the rheostatic element is operated directly by the voltage sensitive device and in which the resistance change is smooth. Each regulator is equipped with a compensating winding which is actuated by differences in voltage between selected points in the main current circuits of the various machines. *No equalizer bus is required*, and since regulators are employed series fields are unnecessary.

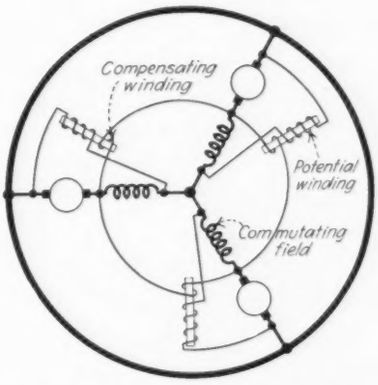


Fig. 2—Parallel operation of three shunt-wound dc. generators, one regulator per machine. Shunt field circuit is omitted

The elementary diagram of connections for two shunt machines in parallel is shown in Fig. 1. The compensating winding connections need only be of control wire. Operation of the regulators results in changes in the shunt field excitation. The two compensating windings are connected in series between two points, A and B, which are at the same potential when load division is correct. Polarity of these windings is such that if generator No. 1 tends to deliver more than its share of the current the potential at B will exceed that at A. This will cause a current to flow from B to A, which in turn will cause the compensating winding of regulator No. 1 to assist the voltage coil and that of regulator No. 2 to oppose its voltage coil. The result will be an increase in excitation of generator No. 2 and a decrease in that of generator No. 1, with ultimate equalization of machine currents.

In instances where it is desired to parallel three or more generators the system of connections is similar. The scheme of regulator connections for three generators is shown in the accompanying diagram. It would appear that any number of generators could be so operated.

This method of operation results in greater flexibility because:

1. Any number of generators can be operated in parallel. 2. Anv generator can be started or stopped with minimum disturbance to other machines. 3. Generators of different size will divide load proportionately. 4. The station is easily enlarged by addition of generator and regulator with a minimum disturbance to old machines. 5. Compound-wound and shunt generators can be operated in parallel. 6. It is not necessary for machines to have identical regulation characteristics.

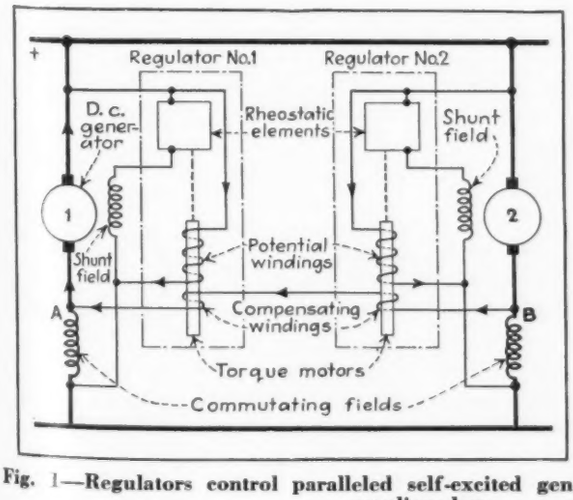


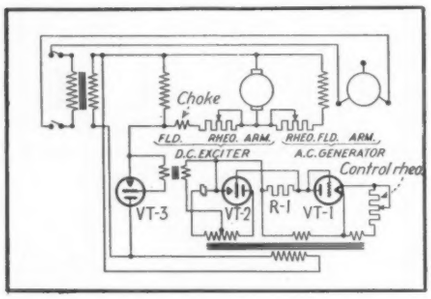
Fig. 1—Regulators control paralleled self-excited generators, without need for equalizer bus

Tests of parallel operation both with and without of two 200-kw. generators, equalizer bus, using this regulating scheme showed that both with and without equalizer bus connections a constant bus maintained with exactly voltage of 234 could be equal division of load over the range from 25 to 425 amp. with speed varied from 290 to 278 r.p.m., thus confirming expectation that equalizer bus is unnecessary. Arrows show direction of momentary current flow in compensating windings if generator No. 1 tends to take more than its share of load.

Electronic Regulator for Parallel Operation

Possible applications for a new electronic automatic alternator voltage regulator, designed for use with only one exciter, include its use in small plants having only one generating unit as well as in providing individual regulators for plants having two or more units in parallel.

Manufactured by Ward-Leonard Electric Company, this regulator is essentially a controlled rectifier that derives its power from the 60-cycle generator it controls. It uses one grid-controlled mercury-vapor rectifier tube whose output is controlled by changing the phase displacement of the grid voltage with respect to the anode voltage. This phase-shifting circuit is actuated by the terminal voltage of the generator by means of an entirely electronic circuit, no moving parts being used. An "anti-hunting" circuit is provided to minimize overshooting and consequent voltage oscillation; automatic protective features are designed to cut out the regulator and return the generator to manual control by exciter field rheostat in case of abnormally low voltage, as from tube failure or short circuit.



Electronic regulator for small plants

Cycle of operation of Type EB regulator as indicated by the circuit diagram (left): Assuming a.c. generator load increasing, generator voltage decreases slightly, decreasing voltage and temperature of cathode of vacuum tube VT-1. Anode current of VT-1 and drop across resistor R-1 decreases, thus decreasing negative bias voltage on the grid of VT-2, increasing the anode current. Phase of grid voltage supplied to rectifier tube VT-3 is altered in direction to increase its output. Shunt field current is increased, raising exciter armature voltage and a.c. generator terminal voltage. As exciter armature voltage rises, it supplies additional current to shunt field, automatically reducing load on regulator. Anti-hunting circuits and protective features not shown on diagram.

It is claimed that the regulator will constantly maintain generator terminal voltage within a band of plus or minus 1½ per cent for all load conditions to full rated kva. Corrective action starts within 1 cycle (1/60th second) of the slightest change in generator voltage and voltage is returned to the normal band within two seconds after any sudden load change up to 50 per cent of rated generator kva., provided the prime mover regulation is kept within 5 per cent and the time constant of the exciter generator combination does not exceed three seconds, according to the manufacturer. Provision has been made to permit the installation of automatic line drop compensation, making it possible to maintain constant voltage at some distribution center rather than at the generator terminals.

•

France Studies Cable-Laying Devices

Cable-laying machinery consisting of a mechanical pick, a digging machine, a cable chariot, sifter and trench filler are being tested in France with a view to lowering the cost of installing cables to isolated small communities, according to an article in the *Electrician* (London).

The pick, digger and filler require a tractor of about 50 hp. while the laying chariot and the sifter coupled together can be drawn by a much smaller machine. In most soils the pick, which is similar to American sub-soilers, can penetrate to a depth of about 20 in. at a time. Deeper trenches require several passages. The digger removes soil and piles it up to either side of the trench, leaving a space between the pile and the trench for the tread of the following tractors. Generally the machine can dig to a depth of 8 in., which permits a 2-ft. trench to be dug at the rate of 300 yards an hour.

Reels of cable up to about 1½ tons can be supported on the cable-laying chariot. Attached behind it is the sifter of wire mesh, over which dirt is thrown by hand so that a layer of fine earth free from stones may surround the cable.

The filler has two blades in the form of a wide angle V which scrape the soil from the sides into the trench. Speed at which the filler works is limited by the speed at which the cable can be laid. On ordinary jobs this will average about 1,000 yd. per day. Rarely is the maximum speed of the digger and filler (1½ miles a day) reached.

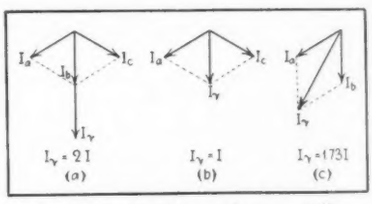
Cost of laying a lead sheath, single-conductor cable at La Ferté Fresnel, France, using this equipment was about 4 cents per yard. Except for foreman and engineer in charge of the construction no skilled labor was required to dig the trench, install the cable and backfill the trench.

•

Wrong Ground Relay Connections Caught

By G. W. STUBBINGS
Winchester, England

It occasionally happens when three current transformers are connected in a three-phase circuit for ground fault protection that the polarity of one of the transformers is reversed due to incorrect terminal marking. In this condition a false residual current appears in the relay when the circuit is normal, and the value of this current is twice the line current, as appears from the vector diagram (a). The straightforward method of rectifying the connections is to change over the leads to the current transformers in turn till the relay current disappears. This procedure is sometimes inconvenient, and the following is a method



Smallest heading shows right connection

whereby the faulty transformer can be identified by a simple test at the relay position:

Open the leads from each current transformer in turn and note the readings of an ammeter in the relay circuit. The transformer which is disconnected when the smallest reading is obtained is the one with reversed polarity.

The truth of this rule is easily seen by a study of the vector diagrams. The B phase current transformer is assumed to be connected with reversed polarity. When the lead from this transformer is disconnected the relay current is seen to be equal to the line current. If either the A or C phase current transformers are disconnected the resultant of the two secondary currents which appears in the relay is $\sqrt{3}$ times the line current. The difference between the relay currents in the two conditions is sufficient for it to be detected with ease, even if load varies.

all over the country-

Copperweld-Copper Conductors

All over the country, rural lines are being built with Copperweld-Copper Conductors, with the certain knowledge that these lines are up to stay up.

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Though low in first cost these lines are providing the ultimate in rural line dependability. Extremely rugged and high in strength, these conductors are able to withstand extremes of weather without loss of safety. Because they stay up and in service, Copperweld-Copper lines are inexpensive to operate.

While Copperweld-Copper Conductors are ordered by the mile, they are bought for the years.

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Industrial ELECTRIFICATION

New ideas and practices in industrial electrification as presented by industrial, consulting and power sales engineers

Electric Boilers Use Off-Peak Power

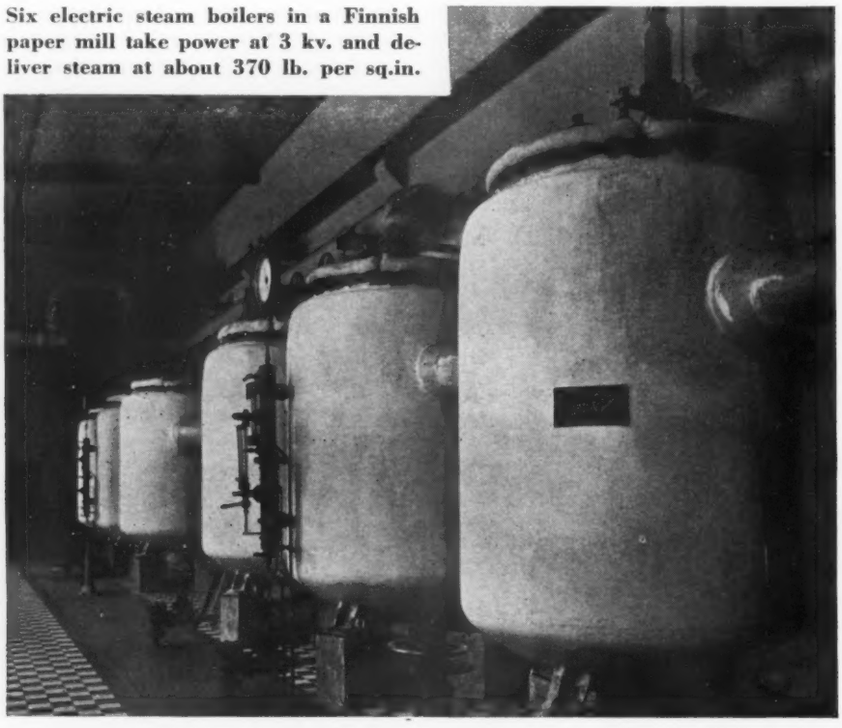
Off-peak power from government hydro stations in Finland is being used for electrical steam generation by the Enzo-Gutzeit paper mill at a cost of 1/20 to 1/25 cent per kw.-hr. Electric steam boilers of the electrode type totaling 34,000 kw. are now installed and additional units increasing the plant capacity to 54,000 kw. are being constructed. Upon completion it is estimated the plant on full 24-hour operation will consume the equivalent of 225 tons of coal burned in a coal-fired system. Power is taken from nearby hydro-stations of 200,000 kw. capacity at a voltage of 110 kv.

Water in electrode-type boilers constitutes the resistance in the circuit and is heated by passage of current between the electrodes. Special construction of the electrodes enables them to be subjected to 10 kv. without porcelain shields or other earthenware material below the water surface. Boilers are operated, however, at a voltage of 3 kv. and a steam pressure of 25 atmospheres. The new boilers being installed are for three-phase operation at 10 kv. Automatic regulators of steam pressure and voltage are provided, as is a device for keeping the ohmic resistance of the boiler water at a constant level.

In setting rates for off-peak power used in these plants the Finnish authorities, owners of the hydro stations, take the view that all electric power which can possibly be produced in the falls should be utilized no matter what price the power brings to the producers. However, calculations of the remunerativeness of such electrode boiler plants are not excluded on account of that.

The cited charges for off-peak power are calculated as follows: In transforming electric power to thermal power without loss 1 kw.-hr. equals 860 kg.cal., and since efficiency of a good electric boiler is 97-99 per cent, the rate of transformation would be about 845 kg.cal. to the kilowatt-hour. It is further estimated that 1 kg. of coal is capable of developing 6,500 kg.cal., and assuming an efficiency of 78 per cent for a coal boiler the actual result is 5,070 kg.cal. per kg. The proportion between electric and coal firing is thus in the ratio of 5,070 to 845, or about 6 kw.-hr., equal to 1 kg. of coal. Price charged for off-peak power to these boiler plants is calculated on this base.

Six electric steam boilers in a Finnish paper mill take power at 3 kv. and deliver steam at about 370 lb. per sq.in.

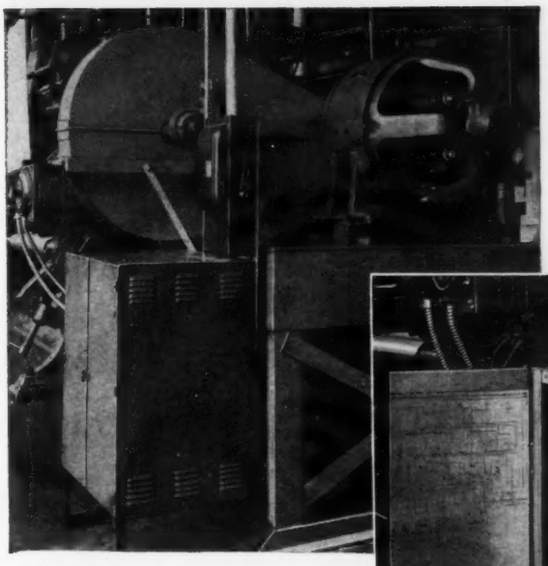


For Reaching Up and Pulling 'Em Out

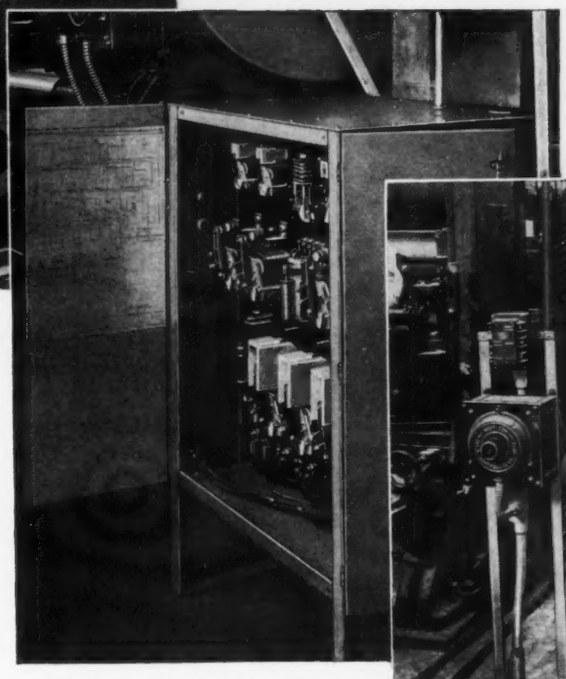
Carrying a stepladder to the spot, maneuvering it among the startling angles and projections of all possible kinds of machine tools, then climbing that ladder after satisfactory footing for it had been found, all looked pretty complicated to one of the electrical maintenance men in the transmission plant of the Chevrolet Motor Company at Muncie, Ind. He felt pretty sure that his disconnect plugs could be pulled from, and restored to, Flex-a-Power duct more quickly and easily.

From his boyhood he called up a picture in his mind of a man trimming a tree, sticking a long pole up among the branches and working a

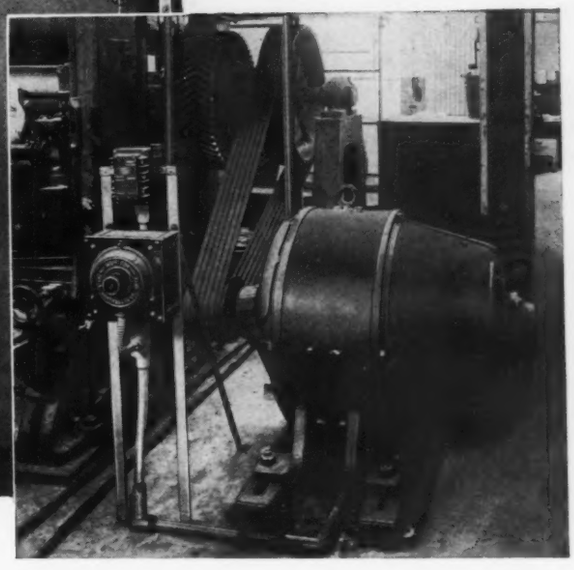
Monitor Control *in* Textile Mills



Cloth Printing Machine 40 H.P. Drive



Close up view of 40 H.P. Print Controller



6 Roll Chasing Calender 40 H.P. Drive, showing speed regulator and push button control

Select the proper control equipment for best operating results

THE above are illustrations of machinery and control equipment in one of the largest textile mills in the South. The functions and operations are governed by Monitor automatic control. These machines, to do the best work, require perfect control over a wide range. They must start smoothly and pull steadily up to running speed. It must be possible to inch the machines and run them smoothly, then accelerate smoothly. While running, the speed must be under perfect control, to decrease or increase without jerks.

Monitor control not only meets these requirements but in addition offers many mechanical and electrical advantages, which with special added safety features help to lessen maintenance and increase production.

Monitor produces many types of control equipment for textile machinery. Typical of these, are controls for spinning and twisting frames, warpers, centrifugals, washers, dyeing, finishing, and processing machines, cloth printing machines, embossers, calenders, and various range drive combinations.

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Your control problem may be much different, but Monitor's standardized control elements will meet it without resort to special parts. That is one of the great advantages of Monitor control. Let us show you how these standard parts can be assembled into custom built controllers at low cost.

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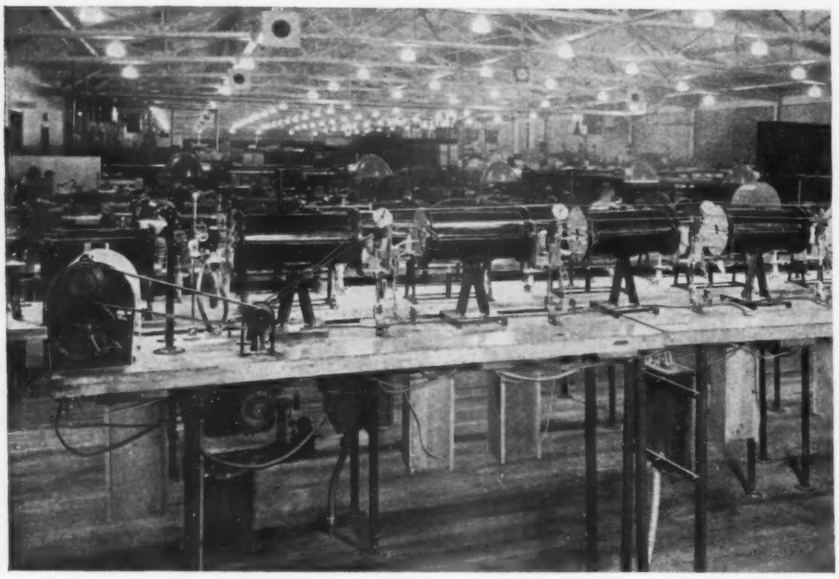
FURNACES DRY COATING ON FILAMENT THREAD



To control the coating of filaments in its new tube-making plant at Salem, Mass., the Hygrade Sylvania Corporation utilizes a battery of sixteen 500-watt Hoskins cylindrical electric heaters through which the filament passes at a speed of 15 meters per minute. Each heater cylinder is 12 in. long and operates on a 115-volt circuit. A ¼-hp. motor drives the mechanism which moves the filament thread through the hollow axes of the heater units. The sequence of exposures to the carefully regulated heat provided by these small furnaces dries the coating uniformly and positively as the filament thread is carried forward in the process. Atmospheric conditions are maintained at a satisfactory value and the process is automatic, no supervision of the kind required with fuel heating being necessary.

hand lever attached to a pole. Then ends of branches, some of them of fair size, would come rustling down. After some cogitation and a little experimenting a tool was built on the same general design as a tree trimmer to grip the fuse block projecting down from the power supply direct. Now there is no more lugging of a step-ladder when a motor fuse is to be replaced or a motor disconnected. Instead, the maintenance man tucks the new tool under his arm and carries it easily to the point of trouble. Then, standing on the floor, he reaches up with the pole, grasps the fuse block with the clamp and pulls it out very easily. And with the same ease restores it when the motor is to be reconnected.

•

Miniature Breakers Cut Lost Man-Hours

"Nofuze" circuit breakers are rapidly replacing fused safety switches in the lithographing department of a tinplate mill. Four of the lithographing machines in this plant are each driven by 3-hp., 250 volt d.c. motors and fuse outages of ten to fifteen minutes were occurring in each of these machines at the rate of one a week. With four operators delayed by fuse outages, it was costing this company 12 cents a minute on each machine when a fuse outage occurred. This amounts to about $7 per week in lost man-hours per machine.

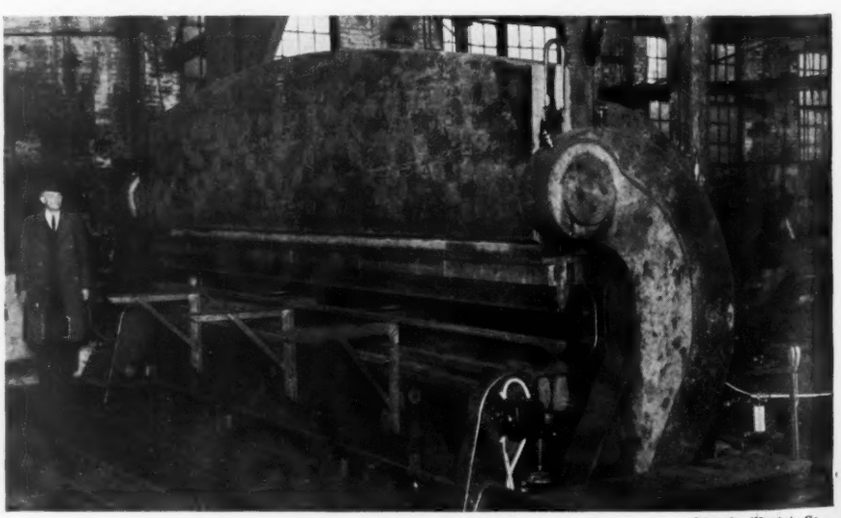
These machines have a comparatively high production rate and it is conservatively estimated that each shutdown resulted in a loss in production of 450 lithographed sheets, or at the low figure of 20 cents per sheet. The production loss on these machines was estimated to be at least $90 each per week.

Since Nofuse breakers were installed on these machines outage time due to overloads, inching and plugging have been negligible.

•

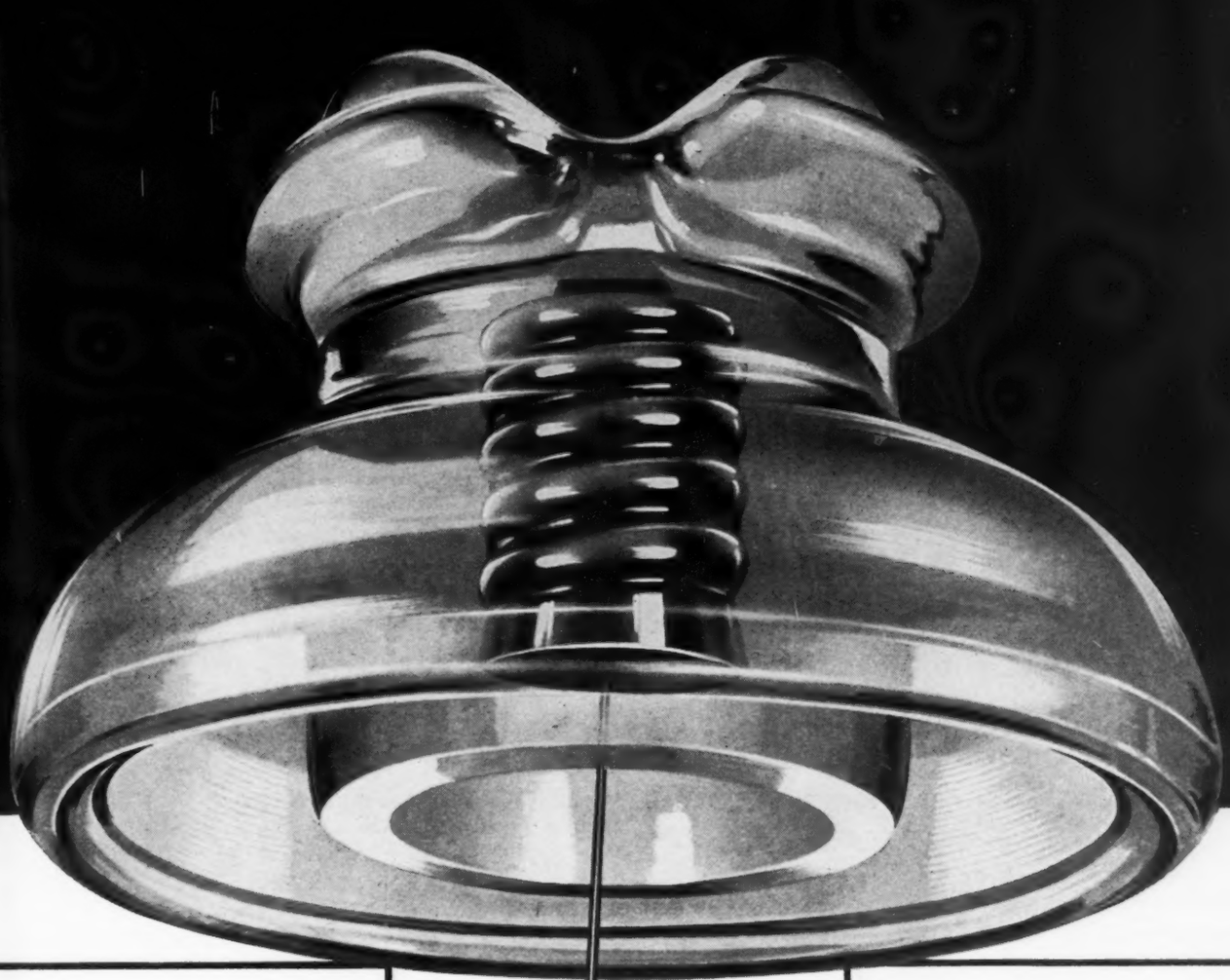
$3,700 Saved by Electric Welding

Sixteen patterns costing $2,000 were eliminated and pattern drawings representing $200 and machining which would have cost $1,500 were done away with by the use of electric welding in constructing this heavy press brake. A reduction of 51.5 per cent in weight was secured and 30 days saved in fabrication. The machine builder reports that the size of the unit made cast-iron construction impracticable, while arc-welded steel provided the necessary rigidity at half the weight. The machine is 24 ft. 2 in. long overall. Construction procedure was greatly simplified and the smooth surfaces obtained by electric welding are a valuable contribution to safe operation. Manufacture is greatly facilitated by the use of standard steel shapes and plates cut to correct size, assembled quickly and accurately in their designed positions and fused directly into a single homogeneous structure. This machine will bend materials 16 ft. long x 0.75 in. thick at the touch of a button.



Lincoln Electric Co.

As rigid as casting but half as heavy



"hat brass bushing eliminates
ll the old troubles caused by
in expansion"
—DISTRIBUTION ENGINEER

"And it saves us plenty of worry, and money too, because it makes Hemingray extra tough"—GENERAL MANAGER

peratives and officials both agree
Hemingray Brass-Bushed Glass
sulators because they render ef-
ient service at reasonable cost
d are available in quantities
eded, at short notice. Hemingrays
r distribution and rural power
es fulfill the requirements of the
ost exacting user. Their perform-
ce in service backs up the judg-
nt of the man who buys them.
rder some today from your jobber,
write for samples and prices.
wens-Illinois Glass Company,
emingray Division, Muncie, Ind.

◆ Brass-bushed for greater strength, perfect threads and full protection against pin expansion.

◆ Hemingray provides many advantages: greater mechanical strength . . . sustained dielectric strength . . . unaffected by sudden temperature changes . . . withstands maximum insulator pin expansion . . . never ages or deteriorates . . . controlled uniformity of product . . . all surfaces impervious to moisture . . . tougher — withstands rough handling . . . clear, flawless for easy inspection. Ratings up to 15,000 volts.

FOR MODERN POWER LINE INSULATION

Order HEMINGRAY Glass INSULATORS

Building Up THE LOAD

New ideas and practices in selling electrical equipment and service to commercial and domestic customers

Isolated Plant Has Erratic Voltage

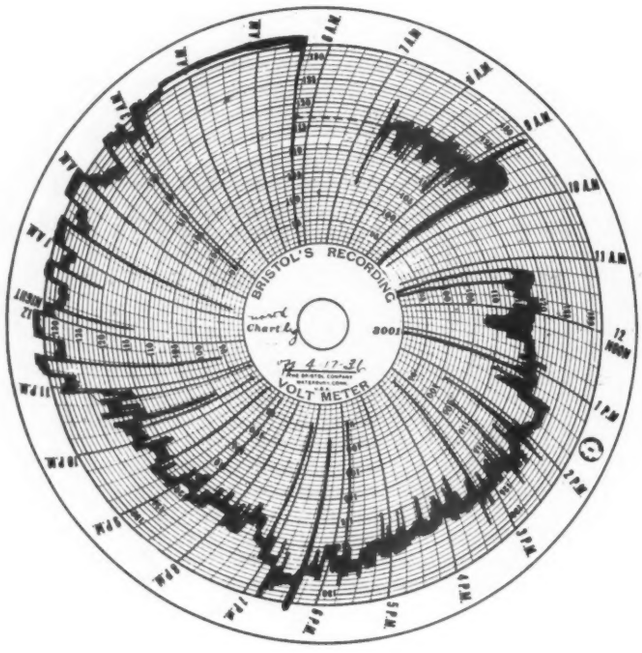
By L. E. BATES

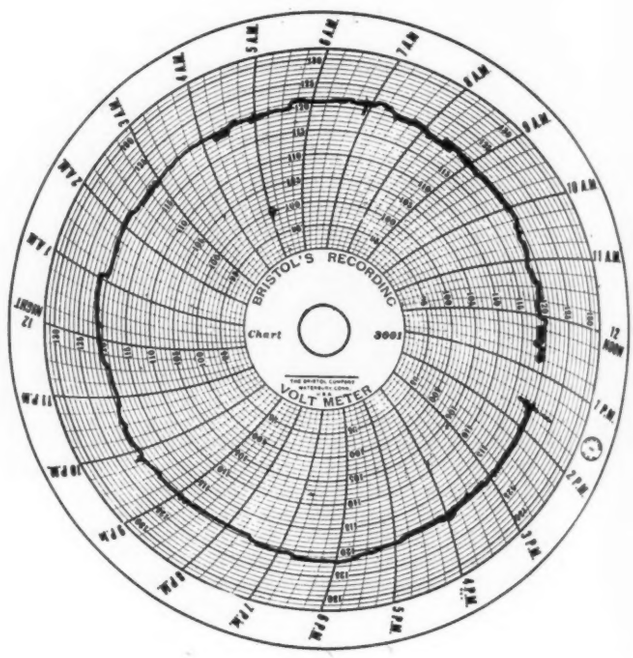
Power Sales Engineer Public Service Company of Oklahoma, Tulsa, Okla.

Minimum variation of 5 per cent in voltage supplied for lighting purposes to private utility customers in Oklahoma is prescribed by the state regulatory commission. Such requirements are common in most states. Through their legally constituted representatives, the regulatory commissions, the people demand, and get, with great willingness on the part of the power companies, a very high quality of electric service. The accompanying voltage charts illustrate that what the citizen demands from the power company is a great deal more than will satisfy him when he installs a plant to produce electrical energy for himself.

The particular citizen in the present instance is the operator of an automobile sales agency in Tulsa. Naturally, he is much interested in the use of automobile engines converted to run on natural gas to supply electricity. The field represents a market for used engines that looks quite attractive to him—and perhaps for new engines too, who knows? Anyway, he decided to throw out the utility service and supply power for his garage and salesroom by means of such an installation. He procured two new engines of the make of automobile he represents (each one of 26.3 hp. S.A.E. rating) and a 37½-kva., three-phase, four-wire generator.

He placed the engines side by side at a sufficient distance apart and set the generator behind and on the center line between them. The generator shaft on the end toward the engines has a wide pulley with two belts, one to each engine. Thus either one or both engines together can be clutched in to drive the generator, the idea being that one engine is to be used for light loads and the other started and





Tale of two voltage charts

At the left is shown the kind of voltage the customer got from his engines, and the installation included a "voltage regulator" at that. Drops of 25 per cent below normal are frequent and sustained overvoltages greater than 5 per cent are numerous. At the right is a typical voltage chart taken in the service area in which the previous customer made the automobile engine installation described in the accompanying story. The maximum fluctuation from normal is 3.3 per cent.

TALENT

A hand, and a little paint brush—what have these to do with heating-element wire?

Well, it takes talent to paint a masterpiece. And it takes something closely akin to talent, to master the problems of making a nickel-chromium resistor alloy, as good as Chromel. Still, we don't claim to be talented, like a genius. But having created the original nickel-chromium heating element alloy in 1906, and having studied it and worked with it for 30 years, it is natural that we have acquired knowledge and skill—which benefit you. Whether you make or sell devices, or use electric heat, yourself—you safely take care of your own, and your customers' interests, when you specify heating elements made of Chromel.... If interested in heating-unit design, you'll find Catalog K useful.... Hoskins Manufacturing Co., Detroit, Michigan.

HOSKINS CHROMEL

THE WIRE THAT MADE ELECTRIC HEAT POSSIBLE

clutched in as the load becomes heavier. This arrangement is typical of the makeshift character of such installations. Not only is it inefficient with an idle belt and pulley running as unnecessary friction load when only one engine is operating, but there is no means for accurately dividing the load between the two engines when both are running.

The voltage chart comparison does not tell the whole story of the operation of the plant. Lamps burned out by overvoltage ran into a pretty penny. Previously the utility had supplied three-phase service for the power load and single phase for the lighting and small devices as listed on the accompanying load count. The single-phase load had to be balanced on the three-phase generator at a considerable expense for rearrangement of wiring in the building.

•

Kitchen Planning Proves Sales Ability

Data on the activities of the kitchen planning division of the Portland General Electric Company reveal its importance in the sales promotion of the larger appliances. During the months of August, September and October, 1936, 56 kitchen plans were prepared for architects and builders and 139 plans prepared for kitchen modernization prospects. Since that time these plans have resulted in the sale of 231 major appliances—118 ranges, 25 refrigerators, 80 water heaters and eight dishwashers.

Layouts were made according to the latest principles of kitchen economy. While no structural detailing is performed in the design, a plan and a perspective view of the proposed kitchen in color are furnished.

The number of units sold per plan within 60 days of the completion of the third period is also of interest. Sixty-two plans were responsible for the sale of one major appliance, 51 plans sold two, 21 plans sold three, one plan sold four, and only four plans were non-productive. In those cases where only one or two units were sold the way has been paved for a possible sale when the customer is able to complete the kitchen as recommended.

Appliances sold added an estimated annual revenue of $8,600 at the additional cost of approximately one-man day for plans issued. The extra drafting room cost is probably more than offset by the reduction in salesmen's time spent in making the sales.

•

"Pill Boxes" Light Hershey Ice Palace

Resembling glorified "pill boxes," three novel ceiling units, each containing 47 1,000-watt lamps, illuminate the 16,800 sq.ft. of ice area in the Hershey Ice Palace, Hershey, Pa., and an evenly distributed intensity of 35 or 40 ft.-candles is reported.

The great concrete arched ceiling is 100 ft. high at the center, acoustically treated, with heavy steel girders projecting about 5 ft. below the ceiling level; all structural steel is covered. Because it was impossible to run conduit either in or out of the poured concrete during or after construction, E. S. Wagner, electrical engineer of the Hershey Estates, had to abandon the conventional method of stadium lighting—that of festooning luminaires in row upon row from the ceiling. As a result, he developed these unusual lighting sources, which he calls "Projectiliers."

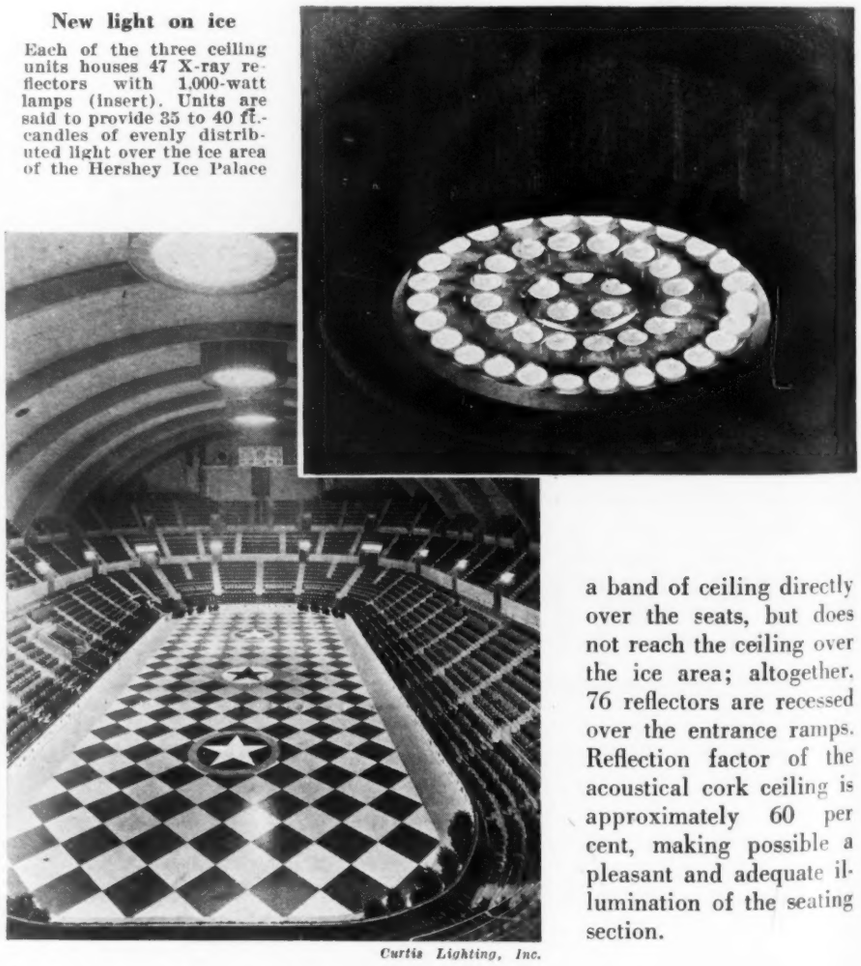
Temperature resistance and maintenance were major considerations in choosing the lighting equipment; design No. 1590 Curtis X-ray reflectors were selected. Each "Projectilier" houses 47 of these reflectors, in addition to the sound equipment and horns installed above the lighting equipment. The ventilated aluminum housing of these semi-concentrating, silver-mirrored glass reflectors is regarded as essential to protect the reflector from possible cracking.

Reflectors are mounted in the units in such a way as to permit their being adjusted at various angles to light each particular type of sports to best advantage; relamping, as well as adjustment, is also facilitated by grouping the reflector equipment in the three-group layout.

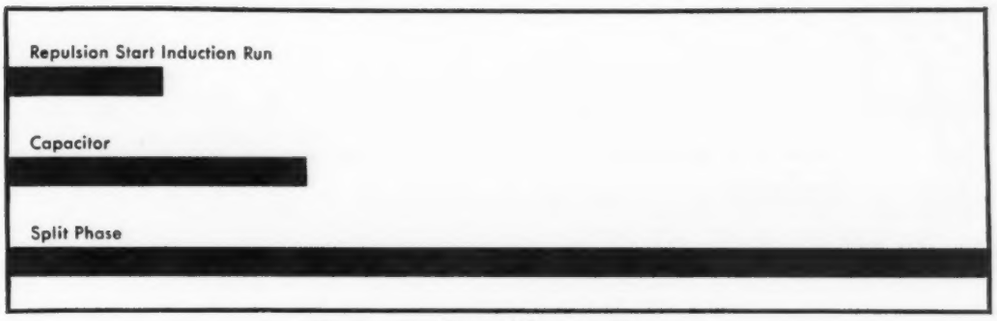
An indirect lighting system supplements the ceiling units. Light from intermittently placed groups of 500-watt X-ray interior floodlights floods a band of ceiling directly over the seats, but does not reach the ceiling over the ice area; altogether, 76 reflectors are recessed over the entrance ramps. Reflection factor of the acoustical cork ceiling is approximately 60 per cent, making possible a pleasant and adequate illumination of the seating section.

New light on ice

Each of the three ceiling units houses 47 X-ray reflectors with 1,000-watt lamps (insert). Units are said to provide 35 to 40 ft.-candles of evenly distributed light over the ice area of the Hershey Ice Palace



Curtis Lighting, Inc.



Current Per Unit of Starting Torque

LOOK AHEAD!

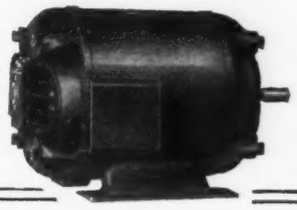
Starting current has a direct bearing on the amount of load you can carry on a given line—and still give satisfactory service to your customers.

That has always been true . . . As far back as 1910, when appliance sales began to grow and Central Stations demanded low starting current—Century Repulsion Start Induction Brush Lifting Motors were developed to meet this situation, which is of greater economic significance today than ever before.

Look Ahead! It is wise to use a low-starting-current motor, having in mind the load your lines will eventually carry—and the problem of maintaining good voltage regulation at the lights in the home, especially when appliances are started.

Century Repulsion Start Induction Brush Lifting Motors are built in sizes from 1/8 to 40 H. P.

CENTURY ELECTRIC COMPANY
1806 Pine Street . . . . St. Louis, Mo.
Offices and Stock Points in Principal Cities



Century
MOTORS

News ABOUT PEOPLE

D. E. Stultz Named President of Maryland Association

D. E. Stultz, commercial vice-president of the Potomac Edison Company, Hagerstown, Md., has taken office as president of the Maryland Utilities As-

sociation for the 1937-38 term. Mr. Stultz has been identified with the Potomac Edison organization since 1919 when he joined the Hagerstown & Frederick Railway, a subsidiary. After serving in various capacities he was appointed manager of the Berkeley Springs, W. Va., district of the parent organization in 1924.

Subsequently he was made district manager at Winchester, Va., general commercial manager of the company and early this year commercial vice-president. For a number of years Mr. Stultz has been active in the association which he has just been selected to head.

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► SIR CYRIL HURCOMB, secretary to the Transport Ministry, has been appointed a member of the British Electricity Commission to fill the vacancy caused by the death of Sir John Brooke, formerly vice-chairman. Upon the retirement of Sir John Snell at the end of the year Sir Cyril is to succeed him as chairman of the commission. At the request of Leslie Hore-Belisha, Minister of Transport, Sir John Snell has agreed to continue to be associated for a time after his retirement with the work of the commission in an advisory capacity.

► THOMAS H. CARENS, vice-president of the Boston Edison Company, in charge of public relations, has been elected a director of the Boston Chamber of Commerce. Mr. Carens has been with the public utility industry since 1930.

► S. M. ZUBAIR, formerly an assistant electrical engineer for the Buffalo, Niagara & Eastern Power Corporation, Buffalo, N. Y., now is employed by the Tata Hydro-Electric Power Supply Company, Ltd., Bombay, India.

► EDWARD CARLSON of the engineering staff of the Blackstone Valley Gas & Electric Company has been elected chairman of the Providence section of the American Institute of Electrical Engineers, and R. J. UNDERWOOD of the New England Power Service Company has been made vice-chairman. OGDEN SNYDER of the latter organization has been elected secretary and treasurer.

► RICHARD T. ERBAN was made the recipient of the Longstreth medal at the annual medal meeting of the Franklin Institute of Philadelphia for outstanding contribution to science by the invention of the Transitorq. The outstanding features of Transitorq design attracting the attention of the judges of the Institute were: infinite change of speed, the positive and efficient transmission of power without gears, belts or pulleys, and the exact control of speed, either automatically or manually—direct or remote—by temperature, light beam, time periods or other mediums.

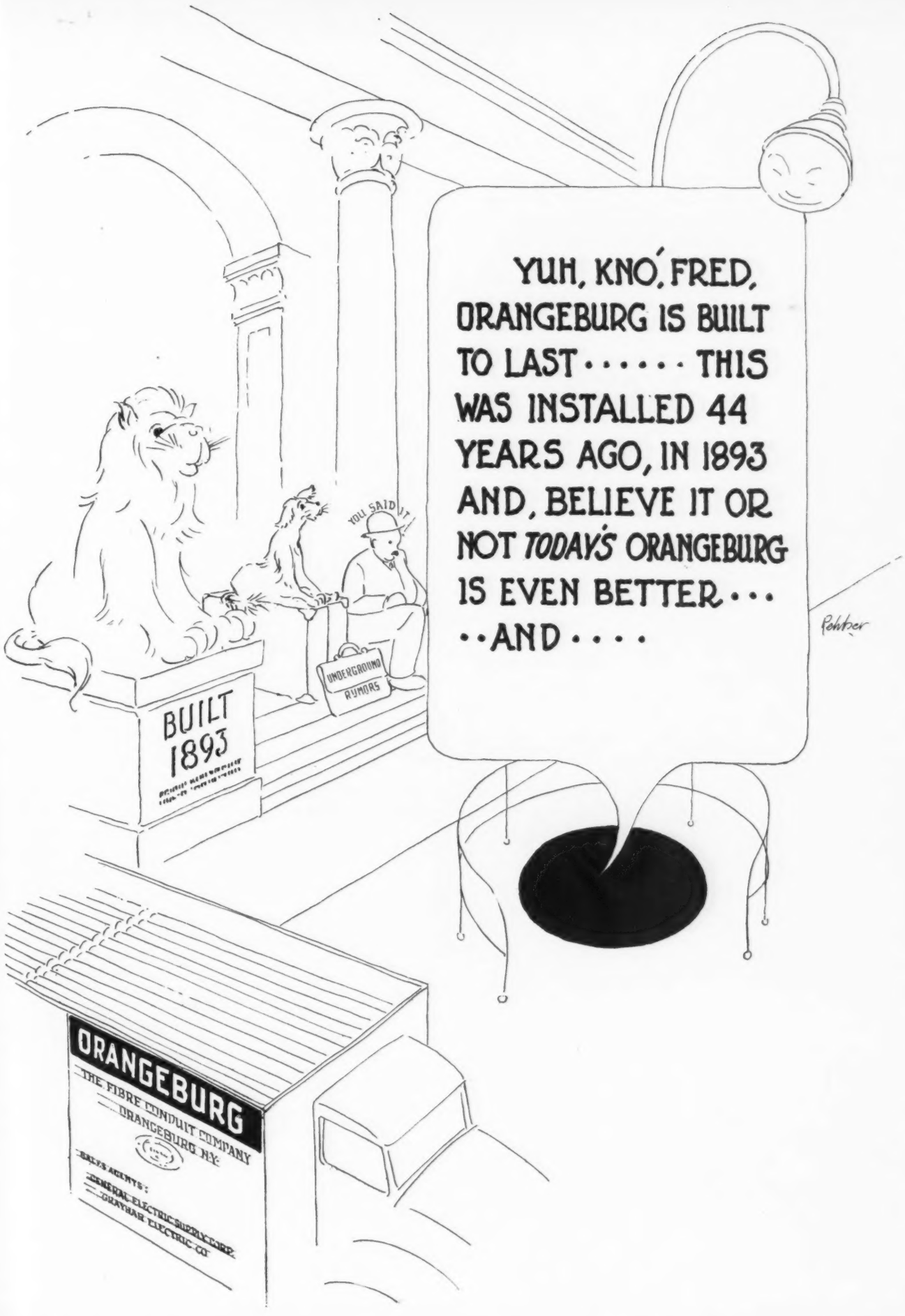
W. G. Harvey Made President of Electrochemical Society

William G. Harvey, sales manager of the American Magnesium Corporation, was elected president of the Electrochemical Society at the recent annual meeting in Philadelphia. This election comes as a fitting honor to a man who has been interested in chemical problems ever since he puttered around his father's basement laboratory in Detroit more than forty years ago.

His first connection, after graduation from the University of Michigan in 1908, was with the Pennsylvania Salt Manufacturing Company, Wyandotte, Mich. Subsequently he became associ-

ated with the Aviation Materials Corporation, Niagara Falls, N. Y., and with the American Magnesium Corporation, which absorbed Aviation Materials. Mr. Harvey stayed at Niagara Falls until the headquarters of the new company were moved to Cleveland.

From 1920 to 1923 Mr. Harvey promoted the development of magnesium alloys, and for 14 years he was in charge of magnesium alloy sales. From 1926 to 1928 he headed the tubing sales division of the Aluminum Company of America, during which


YUH, KNO', FRED, ORANGEBURG IS BUILT TO LAST · · · · · · THIS WAS INSTALLED 44 YEARS AGO, IN 1893 AND, BELIEVE IT OR NOT TODAY'S ORANGEBURG IS EVEN BETTER · · · · · AND · · · ·
YOU SAID IT
UNDERGROUND RUMORS
BUILT 1893
ORANGEBURG
THE FIBRE CONDUIT COMPANY
ORANGEBURG N.Y.
SALES AGENTS:
GENERAL ELECTRIC SUPPLY CORP.
GRAYBAR ELECTRIC CO.
Rehtber

time he lived at New Kensington, Pa., the company's largest works. He has been in Cleveland since 1931.

•

▶ HENRY CZECH, Westinghouse Electric Supply Company, has been elected president of the Milwaukee Electrical League.

▶ G. S. ONORY, formerly an electrical engineer for the consulting engineering firm of Ford, Bacon & Davis, New York, N. Y., is now assistant valuation engineer for the New York State Public Service Commission with headquarters at Rochester.

▶ L. H. HILL, engineer in charge of the Allis-Chalmers transformer division, has been elected chairman of the Milwaukee section of the American Institute of Electrical Engineers.

▶ K. L. HANSEN, prominently identified with modern electric arc welding and associated with the Harnischfeger Corporation of Milwaukee, has been elected chairman of the Milwaukee section of the American Welding Society.

▶ FORREST U. WEBSTER has resigned as merchandising sales manager of Cutler-Hammer, Inc., Milwaukee, to join the staff of Lord & Thomas, New York. Mr. Webster spent three years as merchandising sales manager for Cutler-Hammer and the preceding nine years as advertising manager of that organization. He is chairman of the advertising and publicity committee of the National Electrical Manufacturers Association and a member of the adequate wiring promotion committee and the business development committee. He is a past-president of the National Industrial Advertisers' Association and the Industrial Advertisers Association of Milwaukee.

▶ S. DUNCAN BLACK, president of the Black & Decker Manufacturing Company, is now in Europe, having sailed on May 26 aboard the *Queen Mary*. While abroad Mr. Black will make his headquarters at the company's plant at Slough, Bucks, England. He plans a visit to the Paris International Exposition.

▶ EDMUND BUDNITZ, who has been a member of the Maryland State Industrial Accident Commission for some time, has been appointed a member of the Maryland Public Service Commission by Gov. Harry W. Nice. Mr. Budnitz succeeds Harry O. Levin, who was recently appointed chairman of the Maryland State Tax Commission.

▶ MARSHALL G. MUNCE has been appointed managing director of York Shipley, Ltd., London, England, English affiliate of the York Ice Machinery Corporation, York, Pa. Mr. Munce has been identified with the York organization since 1921.

▶ H. R. ANDERSON, formerly assistant electrical engineer for United States Engineers, Fort Peck, Mont., now is employed as transmission engineer for the Loup River Public Power District, Columbus, Nebr. A native of Huron, S. D., and a graduate of Iowa State College, Mr. Anderson has had experience in engineering and construction work with several public utility companies. He is a member of the American Institute of Electrical Engineers.

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OBITUARY

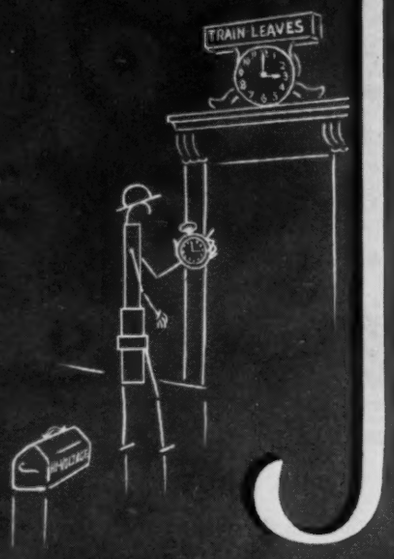
▶ WILLIAM J. REAGAN, vice-president, commercial manager and a director of the Utica Gas & Electric Company, Utica, N. Y., died in that city June 10, of uremic poisoning. He was 58 years of age. Mr. Reagan had been identified with the Utica utility for a number of years.

▶ CHARLES H. GIFFORD, formerly vice-president and treasurer of the American Blower Company, Detroit, Mich., and at one time general manager of the B. F. Sturtevant Company, Boston, Mass., died at his home in Bourndale, Mass., on May 27 at the age of 78.

▶ MAGNUS VOLK, electrical pioneer and builder of Great Britain's first electric railway, died at Brighton, May 20 in his eighty-sixth year. Mr. Volk constructed the first portion of the pioneer electric railway, which runs from the Palace Pier to Black Rock, Brighton, in 1883. His house was one of the first private dwellings in the United Kingdom to be electrically lighted.

▶ PHILIP A. LANG, retired engineer, London, England, died February 25 in his eighty-first year. A native of Germany, he started his technical career with Siemens Brothers & Company, Woolwich, England in 1880. In 1882 Mr. Lang came to the United States and secured a position as head of the testing department of Bergmann & Company, New York, N. Y., where he remained for four years before becoming associated with the Westinghouse Electric & Manufacturing Company. Mr. Lang left this country in 1906 to assume the management of the British Westinghouse Company. He took an active part in elevating it to a commanding position in the industrial life of England and remained as its managing director until it was merged with the Metropolitan Vickers Company in 1918. Mr. Lang was then appointed special European representative for Westinghouse. In 1925 Mr. Lang paid a two-month visit to this country to obtain first-hand engineering information. He was a life-member of the American Institute of Electrical Engineers.

THE NATION MUST TURN TO THE ENGINEER—Gano Dunn, president of the J. G. White Engineering Corporation, told the graduates of M.I.T. last week that engineering has become the cornerstone of industry. Left to right: Vannevar Bush, vice-president M.I.T.; Gano Dunn and Dr. Karl T. Compton, president of M.I.T.



JUST RIGHT!

NOT TOO FAST

To permit the breaker on the secondary to function.

NOT TOO SLOW

To prevent line outage due to primary fault. Clears 20,000 ampere short in ½ cycle.

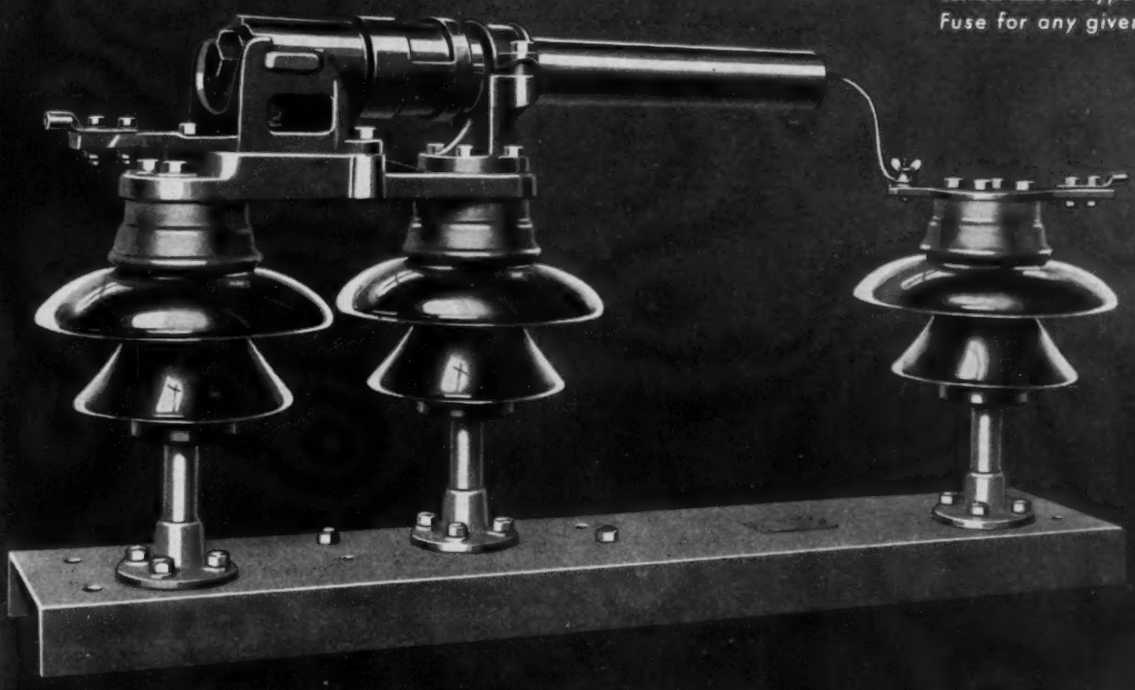
ABSOLUTELY RELIABLE

HI-VOLTAGE Fuses have proved their reliability in both extensive tests and wide service. The burning of the fuse link creates a high pressure within the tube, thereby expelling the gases and any unconsumed portion of the link, at a high velocity. *The arc is cleared within the fuse tube;* the air gap serving chiefly to prevent any leakage of current through or over the fuse tube after the fuse has blown. The tubes are so proportioned that high pressure and velocity are developed on light loads, thereby *clearing any load that will melt the fuse wire.*

HI-VOLTAGE FUSES

Establish an air gap in the line simultaneous with the blowing of the link.

BULLETIN NO. 24 gives all of the information required to select the correct size and type of HI-VOLTAGE Fuse for any given requirement.



HI-VOLTAGE EQUIPMENT CO.

2891 EAST 79TH ST., CLEVELAND, OHIO

Manufacturing AND MARKETS

Water Cooler Sales to Total $2,500,000

More than 25,000 electric water coolers, valued at approximately $2,500,000, will go into American offices, factories, stores and theaters this summer, according to estimates of A. H. Reinach sales manager for the Kelvinator division of Nash-Kelvinator Corporation.

Mr. Reinach declared that with this sale water-cooler production will have jumped 40 per cent from last year's record of 19,000, valued installed at $1,890,000. Improvements in design and color have made coolers more attractive.

•

Auburn Automobile to Make Air-Conditioning Equipment

The Auburn Automobile Company expects to be in production of air-conditioning equipment by the middle of this month, officials announced. A production line for building this type of apparatus has been added to the company's Connersville, Ind., plant and shipment will be started soon, it was stated. The new product, it is claimed, will make possible air conditioning for homes at an initial cost of approximately $250.

Marketing of the unit will be effected through utility companies, plumbers, heating contractors and distributors, it was stated.

•

Electric Range Wins Award

A Crawford electric range was awarded the Edward R. Mitton gold medal in the 1937 New England design competition, Class B for household articles designed for use. This annual competition is open to New England products or products manufactured by companies having factories in New England and the entries in Class B included furniture, silver, dishes, electric clocks and other representative household articles of utility. The Crawford range is manufactured by Walker & Pratt of Boston.

•

Manufacturers Make Sales Appointments

Assignments to the sales staffs of various manufacturing companies have recently been announced:

E. J. Gove has been placed in charge of a new Cutler-Hammer office recently opened in Youngstown, Ohio.

Dampney Company of America has opened a branch office in Atlanta, Ga., in charge of Ray W. Carter, formerly connected with the New York office. L. W. MacLean of the Philadelphia office has been transferred to New York.

S. L. Cordis has been appointed branch manager of the Seattle office of the York Ice Machinery Corporation.

Porcelain Insulator Corporation, Lima, N. Y., has appointed Nelson S. Moore to its sales staff.

General Electric Company announces the promotion of Ralph C. Cameron to assistant manager of the specialty appliance sales division, Nela Park, Cleveland.

Ward Leonard Electric Company has appointed J. Y. Dahlstrand as special representative to handle the sale of automatic alternator voltage regulators. Mr. Dahlstrand's offices are in Burlington, Iowa.

Corning Glass Works has appointed the Haworth L. Brueck Company, Chicago, Ill., as its representative for the sale of "Pyrex" power insulators in Iowa, Wisconsin, Illinois and Indiana.

Allis-Chalmers Manufacturing Company has opened an office at 211 North Champion St., Youngstown, Ohio. This office will be in charge of C. H. Legler.

Herman E. Held has been appointed to succeed the late C. F. Henderson as manager of the San Francisco agency of the Weston Electrical Instrument Corporation, with offices at 420 Market Street.

•

Vacation Week Announced

Announcement has been made that the Harold E. Trent Company, Philadelphia, Pa., will close its plant for the week of July 5 for vacations.

Shipments of Trucks, Tractors Are Higher

April shipments of electric industrial trucks and tractors exceed those of a year ago by 45 per cent and more than doubled those of the month in 1935, it is announced by the Bureau of the Census.

Shipments during the first four months of 1937 were 66 per cent ahead of 1936 and 165 per cent ahead of 1935. Orders during the same period were 93 per cent ahead of 1936. Comparative figures are as follows:

	Shipments			New Orders		
	1937	1936	1935	1937	1936	1935
Jan.	152	84	42	129	76	45
Feb.	142	75	58	159	69	59
March	141	89	59	174	97	68
April	162	112	75	244	123	72
4 Mo.	597	360	234	706	365	244

•

Anaconda Wire & Cable Begins $200,000 Addition

Anaconda Wire & Cable Company, New York, N. Y., has begun erection of a new addition to branch plant at Marion, Ind., consisting of a one-story unit, 120x450 ft., reported to cost close to $200,000, including equipment. General construction contract has been let to B. J. Nelson, Marion. F. E. Hart is plant manager at Marion.

•

Packard to Build Addition

Packard Electric Company, Warren, Ohio, has plans maturing for new one-story addition to plant, 200x400 ft., reported to cost more than $200,000, with equipment.

•

Exhibit Attracts Throngs

The sixth annual electrical progress exhibit sponsored by the Electrical Association of Philadelphia was held in

To Managing Executives . . .

WHO WOULD LIKE TO CUT RED TAPE IN PUBLIC RELATIONS

MOST executives agree that if clumsy, "red tape" handling of customer contacts could be eliminated, a very sore spot in public relations would automatically be healed.

Remington Rand has developed plans and methods which, installed in leading utilities, have done much to minimize this source of ill will. Users report such major advantages as these:

1. Customers have only one place to go—need never tell their stories a second or third time.

2. Customer contact clerks handle every situation with full and accurate knowledge of all previous experience as well as up-to-the-minute data on present conditions.

3. All questions are settled on the spot. No need to get in touch with the customer again by mail, telephone or personal call.

4. Customer service is so speeded up that a duplicate bill or complete information on a high bill complaint, for example, is put in the clerk's hands inside of one minute.

5. Absolute privacy for every interview is appreciated by even the customer making an application for service. Your clerks work more efficiently when the customer's attention is not distracted.

These and many other advantages—are possible simply through proper organization of customer contact facilities and proper centralization of information. Instead of adding overhead, operating costs are actually reduced. Upon request, Remington Rand will be glad to make a study of your situation and submit detailed recommendations and organization charts designed to fit your individual requirements. This service is without obligation. Phone your local Remington Rand office or write Remington Rand Inc., Buffalo, New York.

OK.. it's from Remington Rand

the Edison Building last month. Products of fifty companies were displayed in sixty-five booths. The exhibit covered a comprehensive display of equipment, including lighting, motors and motor control, switchgear, instruments of precision, wire and wiring devices, heating and ventilating, etc. Registration during the three-day run of the show totaled about 6,000 visitors.

•

Air Conditioning Sales Gain

Contracts for 88 air-conditioning plants of 1,321 hp. combined capacity for Chicago were closed in May, the Commonwealth Edison Company reports. This was a new record for the month and showed a gain of 20 per cent in number from last year and a 94 per cent gain in capacity. There were 30 installations for restaurants and fourteen installations for private offices in addition to others.

•

Frigidaire to Expand

Erection of two new factory buildings together with enlargement and rearrangement of the Moraine City, Ohio, manufacturing facilities of Frigidaire division, General Motors Corporation, will be started within the next few weeks, it was announced this week. The program will involve an expenditure in excess of $4,000,000.

•

Hyman Michaels Moves Office

Hyman Michaels Company has removed its general offices from 20 North Wacker Drive Building to the Peoples Gas Building, 122 South Michigan Avenue, Chicago.

•

York Installs New Air Units

Outstanding among recent installations of air-conditioning equipment in industry are those in the Ford branch assembly plants in Memphis, Tenn., and St. Paul, Minn., made by the York Ice Machinery Corporation.

New York Metal Prices

	June 9, 1937 Cents per Pound	June 15, 1937 Cents per Pound
Copper electrolytic..	14.00*	14.00*
Lead Am. S. & R. price.....	6.00	6.00
Antimony.....	14.75	14.75
Nickel ingot.....	35.00	35.00
Zinc spot.....	7.10	7.10
Tin Straits.....	56.00	54.625
Aluminum, 99 per cent.....	20-21	20-21

* Delivered Connecticut Valley.

Field Reports on Business

A decided slowing up in production activities is indicated in reports. Pessimism regarding industrial peace is indicated by the spread of strikes, causing loss of wages and business. Backlog orders are keeping manufacturers running at a fairly good rate.

NEW ENGLAND

Orders placed recently in this district reflect a wide variety of applications of electrical equipment and lessen still further the backlog of negotiations which have been carried along in good volume for some time. Turbo-generator orders were closed a short time ago for two units aggregating 2250 kw. which will be installed in Connecticut industrial plants. Small motors are selling well; reversible type motors for high-speed planers totaling 175 hp. were bought by a prominent Connecticut machinery manufacturer recently; one order for fractionals aggregating over 100 hp. and another order furnishing 250 hp. were placed with machine manufacturers in Massachusetts during the past fortnight. Inquiries are less active and some difficulty is reported in reaching agreements for deliveries due to labor troubles.

Switch and control apparatus is moving well; sales of control equipment for electric welding units are encouraging; new panel installations amounting to about $3,500 were ordered from one well-known manufacturer during the past week. Small orders are being received in good volume.

Sales of combination mercury-tungsten lamps in this area are very active for industrial service. Two recent orders of importance were placed with the G.E. Vapor Lamp Company by the Warren Telechron Company, Ashland, Mass., and the Pepperell Manufacturing Company, Biddeford, Me., involving a total outlay of over $20,000, including wiring. In two weeks 334 electric refrigerators were sold in Vermont ending June 9; in the same period 37 electric ranges and fourteen water heaters were bought.

PACIFIC COAST

Total Coast building is averaging 25 per cent over last year, although May recorded a slight decrease under April. Greatest percentage of increase is in the Northwest, with 70 per cent, and Salt Lake area, which has long been underbuilt, with 90 per cent. Electrical business is very well distributed over the territory and well assorted by lines, though dealers' purchases, especially in the Bay region, have been hit by uncertainty over labor conditions and by efforts to liquidate stocks. Wholesalers, too, are cutting all purchasing to an irreducible minimum.

One million dollars intended for street-lighting improvements has been eliminated from San Francisco budget for the coming fiscal year, leaving no available funds for installation of electroliers by private contractors. Widespread civic pressure is being exerted upon Washington for continuance of PWA and its 30 to 45 per cent grant principle scheduled for discontinuance in June. Recent Hawaiian business includes $80,000 G.E. trolley coach equipment and $191,300 award for electrical distribution system at Hickam Field.

Manufacturers report a temporary dearth of large specific orders for heavy machinery, although general run of stock transformers and motors is good. Additional generating equipment for Boulder Dam and large transformers ranging from 2,500 to 667 kva., 6,900 to 69,000 volts for the Seminoe plant in Wyoming are scheduled for early award through Denver. The annual revenue from Boulder Dam service, which officially began on June 1, is estimated at 1¼ billion kilowatt-hours for $1,500,000.

CHICAGO

Orders for electrical equipment maintained a steady volume last week. The demand for heavier equipment lessened, but many of the smaller items showed increases over the previous week. Transformers and fractional horsepower motors were sold in good volume and wire and cable sales were reported excellent. Wiring devices and flexible conduit sales decreased moderately. Outdoor lighting equipment is moving at a satisfactory pace.

Commonwealth Edison Company reported 88 air-conditioning installations completed during May, an increase of 20 per cent in number and 94 per cent in capacity over the comparable month in 1936. Refrigerator and range sales continued well ahead of last year. Central station supplies showed a moderate decline from the previous week, but indications for an early pick-up are promising.

Activity in the southern industrial district was adversely affected by labor difficulties. A fairly heavy volume of orders for electrical equipment is still being held up pending the outcome of the steel strike. The outlook in other fields was more optimistic, however. Wholesalers reported a heavy turnover as retail trade steadily improved.

NEW YORK

Pessimism regarding the immediate, and for some the long-term, outlook is sweeping aside hopes of industrial peace and of stabilizing economic prosperity. The spread of strikes, fostered by the C.I.O., in the utility, steel, coal and automobile industries has resulted in a decided slump in production. Not only are wages, purchasing power and earnings of corporations being lost but also taxes which the Treasury had hopes of collecting this year are fading because of the industrial strife.

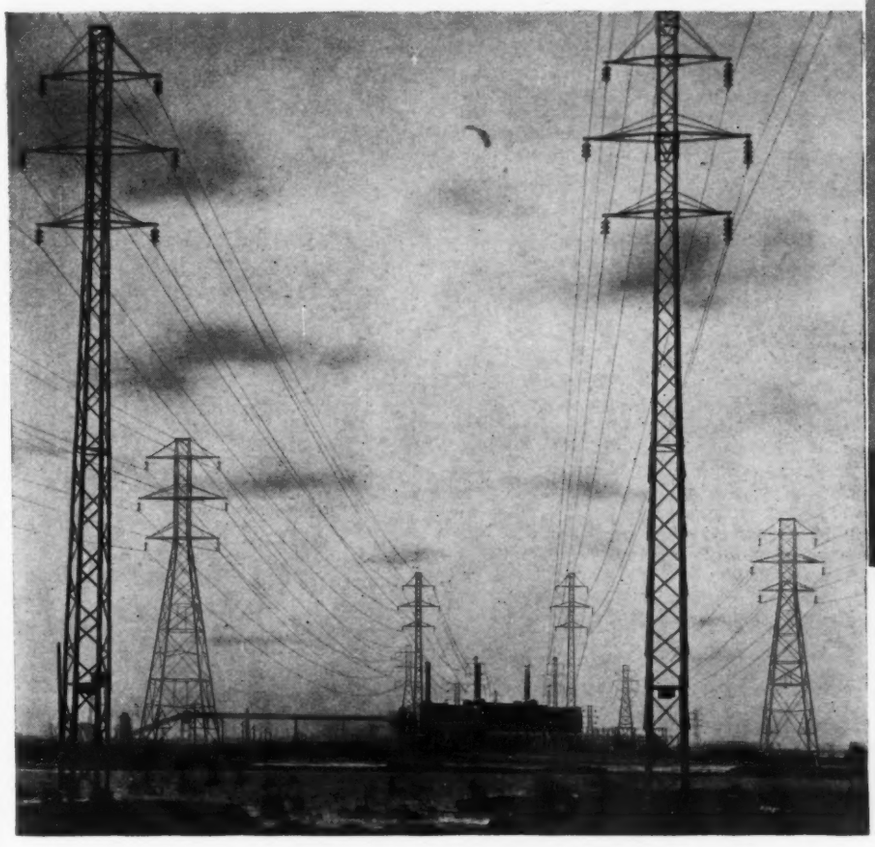
Electrical manufacturers report that business is holding up fairly well due to the backlog of orders and necessitous buying.

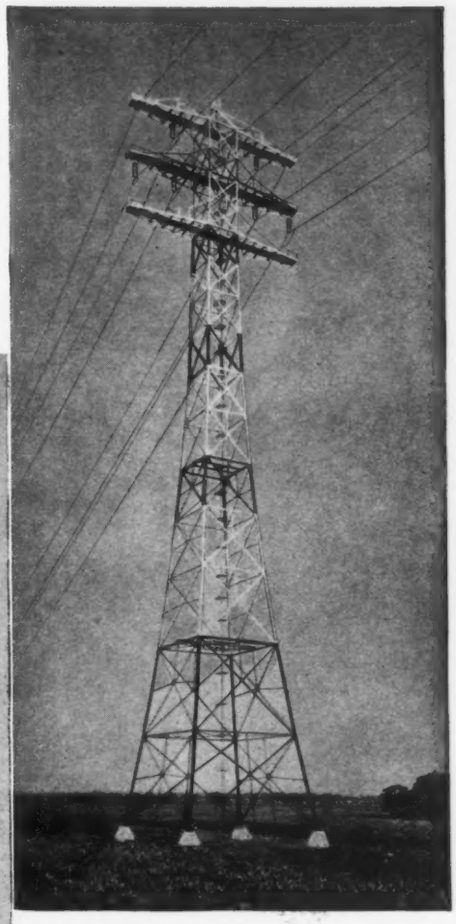
Many large concerns are turning their attention to labor-saving devices as a means of maintaining some semblance of profitable operations and as an offset to the demands of labor for higher wages. This means that while those working may get higher wages there will be fewer on the jobs.

Retail sales of electrical appliances are good, with refrigerators making the best showing. Air-conditioning sales continue on the increase.

The utility strike in Michigan has created another problem for the industry. Reports from many sections of the country indicate that the C.I.O. is expanding its drive to organize utility workers.

Always Look to
AMERICAN BRIDGE COMPANY
for TOWERS





Mississippi River Crossing of the Baton Rouge Electric Company carries power lines 3750 feet between towers. Crossing designed by Stone & Webster Engineering Corporation. Steel towers fabricated and erected by American Bridge Company.

Left Power lines of various voltages radiating from the Deepwater Power Plant in New Jersey.

THE growth of electric transmission lines, spreading fanwise from hundreds of strategically located generating plants, symbolizes our national development. These lines bring service — light, heat and power—to industrial centers and rural districts.

Like other construction works that span rivers, mountains and wide stretches of plains, the design of efficient transmission tower systems involves many and varied engineering problems. Since 1905, these problems have been handled by American Bridge Company in its design, fabrication and erection of steel structures of all types for electric transmission. Its engineering and operating organizations have kept pace with every development and have devised new features and special adaptations which result in more economical and effective design and construction.

One entire plant is devoted to the fabrication and galvanizing of towers, and also provides modern facilities for full-size tower testing. Always look to American Bridge Company's resources and services to handle your tower requirements with greatest efficiency.

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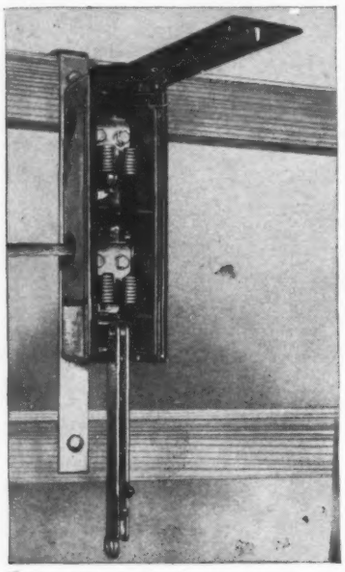
UNITED STATES STEEL

New EQUIPMENT AVAILABLE

Disconnect Switch

Principal features of this newly announced disconnect switch: a dead blade isolated from both contacts in the open position; large spacing between contacts to eliminate



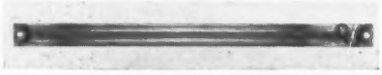
Dead blade disconnect switch; rated 600 amp., 7.5 kv. **James R. Kearney Corp.**, St. Louis.

line-to-line flashovers in open position; multiple-point pressure contacts that clean blade after each operation and hold within temperature rise requirements for its rating, and design permitting blade to hang straight down even when door is closed. It has a swivel type hanger and is designed to be mounted on two crossarms spaced 24 in. apart.

•

Small Heating Units

Two additions to this company's line of heating units—a "strip" heater with offset terminals to facilitate wiring and arrangements of strip heaters in series; cartridge-type heating unit, for use where a "spot" of heat is required within a limited space. Latter unit is only ⅜ in. in diameter and is made with brass sheath for maximum operating temperatures of 750 deg. F. It is particularly suggested for use in built-in installations. A busbar developed for use with the new strip heater allows a wide range of spacing.



Strip heater with offset terminals, top, in various lengths and ratings. Cartridge-type unit, bottom; 30, 75 and 90 watts at 115 or 230 volts, a.c. or d.c. **General Electric Co.**, Schenectady.

•

Immersion Heater

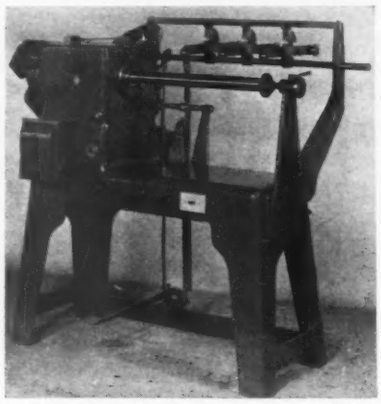
Trent immersion heater for plating tanks; rated at 3 kw., 230 volts. **Harold E. Trent Co.**, Philadelphia.

Immersion heaters are offered for use in plating tanks. Casings are of copper, steel or other alloys and lead coated when required for nickel plating, chromium plating, acid copper and acid zinc baths. A new process for putting on the lead is said to give the lead a denser value and better heat conductivity and to increase its resistance to the action of chemicals in the bath. Units are available for hanging over the side of tank or bent at right angles for shallow baths.

•

Transformer Coil Winder

A high-voltage transformer coil winder is the most recent addition to this company's line of armature and coil-winding machinery.

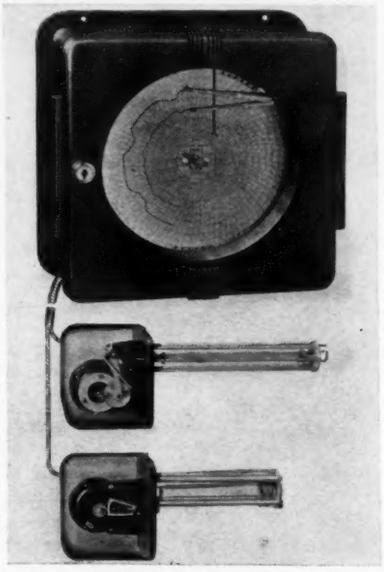


No. 3B; for wire sizes from No. 20 to 8; can be equipped with total turn counter and layer counter. **The Globe Tool & Engineering Co., Dayton, Ohio.**

For coils from 6 to 24 in. in diameter it will wind widths automatically up to 8 inches, the manufacturer states. Equipping the machine with the reverse switch and using the back gear converts machine into a low-voltage winder, making the machine quite universal for transformer production winding. It is also suggested for use in production winding of low-high-law transformers and is said to be capable of winding as many as six secondaries at a time.

Humidity-Temperature Recorders

New round chart recorders for relative humidity and temperature have electric clock movements as standard equipment. One type



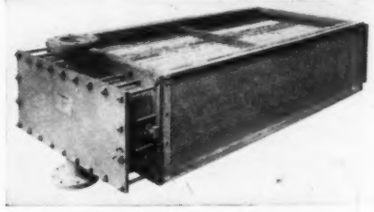
Humidity-temperature recorder; handles relative humidity range from 0 to 100 per cent; standard temperature range, 0 to 100 deg. F. **Julian P. Friez & Sons, Inc.**, Baltimore.

of recorder is said to have an exclusively new feature in that it transmits relative humidity direct from any remote point. Only connection needed between humidity and temperature sensitive element is a low-voltage five- or eight-conductor wire, says the manufacturer.

•

Air Coolers

Recently announced finned air coolers are designed to cool air or other gases for turbogenerators, synchronous condensers, waterwheel generators and other apparatus, particularly in locations where the surrounding air is moist or contains corrosive acids or

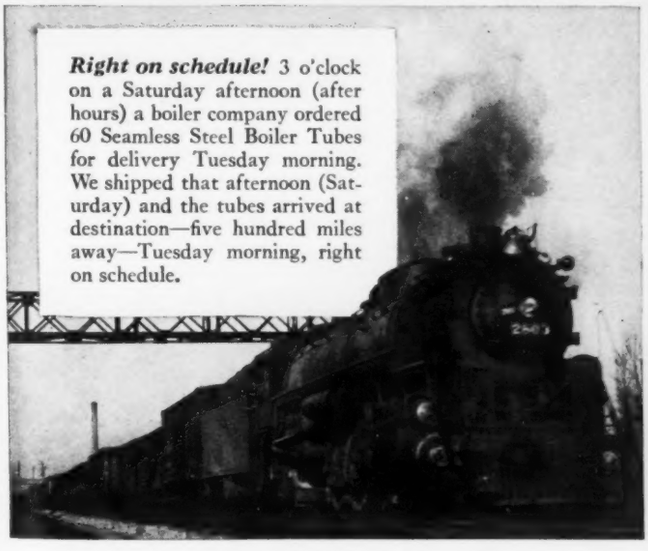


Air cooler. **Westinghouse Electric & Manufacturing Co.**, East Pittsburgh.

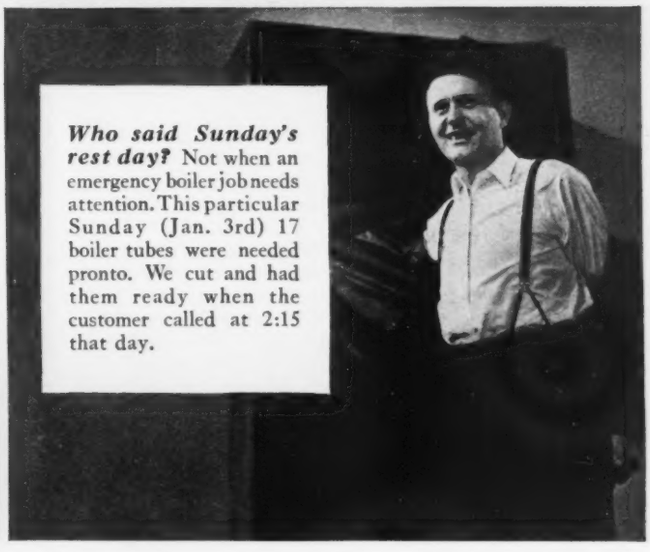
What we mean by
"SCULLY SERVICE"...

"You can get it here this afternoon? Good!" A foundry 25 miles distant phoned a rush order for angle iron, needed in an emergency. Order was placed at 11 o'clock. We made delivery at 2:30 that afternoon.

Order came in after 5 o'clock from a company about 225 miles north of Chicago. This company needed 120 channels in a hurry. We shipped that same night, delivery was made next morning.



Right on schedule! 3 o'clock on a Saturday afternoon (after hours) a boiler company ordered 60 Seamless Steel Boiler Tubes for delivery Tuesday morning. We shipped that afternoon (Saturday) and the tubes arrived at destination—five hundred miles away—Tuesday morning, right on schedule.



Who said Sunday's rest day? Not when an emergency boiler job needs attention. This particular Sunday (Jan. 3rd) 17 boiler tubes were needed pronto. We cut and had them ready when the customer called at 2:15 that day.

Next time try Scully

Do you find it hard to get your steel orders filled these days when mills are choked with orders? Try Scully. Our huge stocks are quickly available. We have immense stocks of steel, steel products, copper and brass always on hand in eight warehouses conveniently located.

Phone, write or wire the warehouse nearest you. Send for our complete Stock List and Reference Book. It's free.

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UNITED STATES STEEL

dust. Cooling surface consists of admiralty metal tubes, upon which spirally wound copper fins are mounted. Cooler is said to be so designed that any single tube may be removed from the tube bundle without disturbing adjacent tubes.

•

Disconnect Switch

Quick-break design is a feature of this disconnect switch. Special spring contacts designed to function when the switch is jerked

Catalog number C-353004-1; ratings, 7.5/12.5 kv., grounded Y, 400 amp. **Line Material Co.**, South Milwaukee.

open prevent arcing on the main contacts and delay opening the circuit until the last moment, it is declared. Protruding pull ring, a pry-out feature, dead hinge blade, full floating terminals of the clamp type and a Bakelite door that stays closed with the blade in open or closed position are other characteristics of the switch.

•

Cable Compound

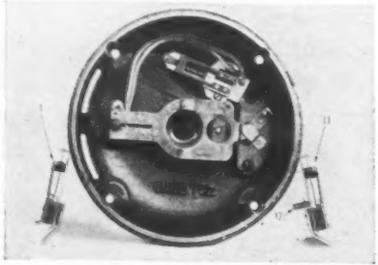
"Flamenol." **General Electric Co.**, Schenectady.

A new synthetic insulating compound is said to be similar to rubber in its characteristics, yet to contain no rubber, to be noncombustible and highly resistant to moisture, acids, alkalies and oils. It is further said to have excellent aging characteristics and to be strong mechanically. Cable insulated with the compound is recommended for power and control circuits at 600 volts and less and for operation at a maximum copper temperature of 60 deg. C. It is available in a variety of colors for circuit tracing and for most applications is used without any protective finish such as braid, lead or armor.

•

Small Motor Protector

A new protector for fractional-horsepower motors is designed to permit safe operation of the motor above 140 per cent rated current for a limited time. Two separate bimetal elements are used; one for over-temperature protection and the other, actuated by current alone, to open the circuit promptly in case of stalled rotor. This current-operated element is said to differ from conventional design in that it does not pull down the temperature at which the device functions on overload. Underwriters' approval for the combination of this protector with any standard motor can be obtained through the makers, it is claimed.

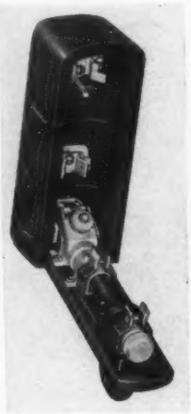


"Motor Cop" protector; type at (1) is automatic-reset model; manual-reset type (11) has reset button at (12); shown mounted in end bracket of motor. **Micro Switch Corp.**, Freeport, Ill.

•

Inclosed Cutout

At the lower end of the fuse tube on this inclosed cutout is a new terminal, which has been developed to make it easier for lineman and troublemen to re-fuse the cutout, even when they are wearing heavy gloves. New terminal is a knurled nut of ample size which permits a tight connection with the fuse link cable and eliminates the need for threading the fuse link.



Type SEB; ratings, 50 amp., 5,000 and 7,500 volts. **Schweitzer & Conrad, Inc.**, Chicago.

•

Automatic Welder

There are no switches to adjust for heat changes on a recently developed automatic a.c. welder. The operator pushes one of two

"Gen-Arc;" line voltage, 220-440, 60 cycles, single phase; ten heat changes, 15-225 amp.; 1/16 to ¼-in. rod. **The General Equipment Co.**, Wichita, Kan.

buttons on the electrode holder and the changed amperage is indicated on the illuminated dial of the welder. One button controls increasing heats, the other decreasing heats. Control system employed is said to make possible a lower open circuit voltage without sacrificing ease of operation.

•

Secondary Circuit Arresters

Type LV; for service on 110, 220, 440 or 550 volts. **Westinghouse Electric & Manufacturing Co.**, East Pittsburgh.

Protection against burnouts of watt-hour meters and flashovers in consumer house fixtures is said to be assured by these secondary circuit arresters, having a surge capacity of 15,000 amp. and including valve type arrester, drop-out feature and ample insulation. Arresters, connected from phase to ground, are made up of mica-spaced carborundum disks. An "Autovalve" discharging element, consisting of a porous block, is held in the smaller of two porcelain pieces making up the casing. Series gap on the line side of the block consists of copper electrodes separated by mica spacers.

•

Time-Study Device

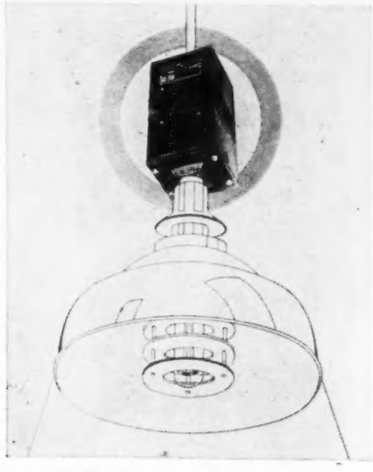
"Marsto-graph;" standard voltages, 110 and 220, 60 cycles. **C. A. Marston Co.**, Braintree, Mass.

A remote-controlled device newly designed makes continuous automatic time studies in graphic form on a slowly moving paper tape in such a manner that a complete story of operating efficiency, output and idle machine time may be had at a glance. It connects electrically to any machine or process operation in the plant, says the maker, and may be located at the machine or in the office a half mile away. A small self-starting synchronous motor operates paper feed mechanism which moves the perforated tape at a lineal speed of 5 in. per hour.

•

Mercury-Vapor Lamp Transformer

Cool operation of new transformers designed for use with the 250- and 400-watt-high intensity mercury- vapor lamp is said



High-intensity mercury-vapor lighting transformer. **The Acme Electric & Manufacturing Co.**, Cleveland.

to be insured through the use of extremely thin laminations of high silicon steel for the core and of oversize wire for the coils, which are of the armored insulation type, double impregnated. Universal mounting features adopt it to wall, ceiling or pendant mounting. Connections to line or lamp are made at the two positive-contact terminal panels, which have four primary taps, no joints or taping being required.

•

Flexible Coupling

"Steelflex," FA series, in ratings from 0.4 to 18,000 hp. **The Falk Corp.**, Milwaukee.

A greater degree of parallel and angular shaft misalignment is said to be allowed by these flexible couplings because of the full floating characteristic of the coupling spring and cover. Coupling consists of two identical steel hubs, whose peripheries are grooved to receive alloy steel grid springs and two duplicate steel shells forming the cover.

Improve working conditions—slow up accidents—with paints that scientifically *spread light*

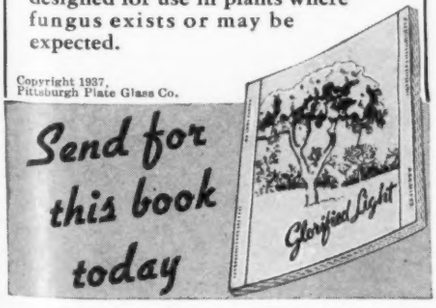
THE THREE GLORIFIED LIGHT SYSTEMS

The Snolite System is intended for use in plants with normal interior exposures.

The Snotex System is designed for use under abnormal conditions except where fungus growth is present. It stubbornly resists discoloration from humidity, fumes, gases and lack of daylight.

The Funguside System has the same properties as the Snotex System and it also checks the growth of fungus. It is designed for use in plants where fungus exists or may be expected.

Copyright 1937, Pittsburgh Plate Glass Co.



GIVE the eyes of your craftsmen a better break! Banish dangerous shine and shadow—costly gloom and glare—from your plant with light-diffusing paint.

Pittsburgh Paint scientists, working with the world's leading experts on light and sight, have perfected three revolutionary new systems of interior finishing for industry and business. These remarkable Pittsburgh Paints convert raw light into safer, more practical, more efficient light—*glorified light*—at minimum cost.

When Glorified Light products are applied, soft-toned walls and ceilings scientifically control and diffuse all available light—both natural and artificial. Then restful illumination—easy on the eyes—relieves sight strain and improves workmanship.

Ask our local Pittsburgh representative about these famous new Glorified Light products, or mail the coupon below for our authoritative booklet on the subject. *These advanced paint systems will pay their own way in your plant in terms of cash profits.* Pittsburgh Plate Glass Company, Paint Division, Pittsburgh, Pa.

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COMPLETE LINE OF STRUCTURAL MAINTENANCE FINISHES

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Please send me, free, your new book, "Glorified Light".

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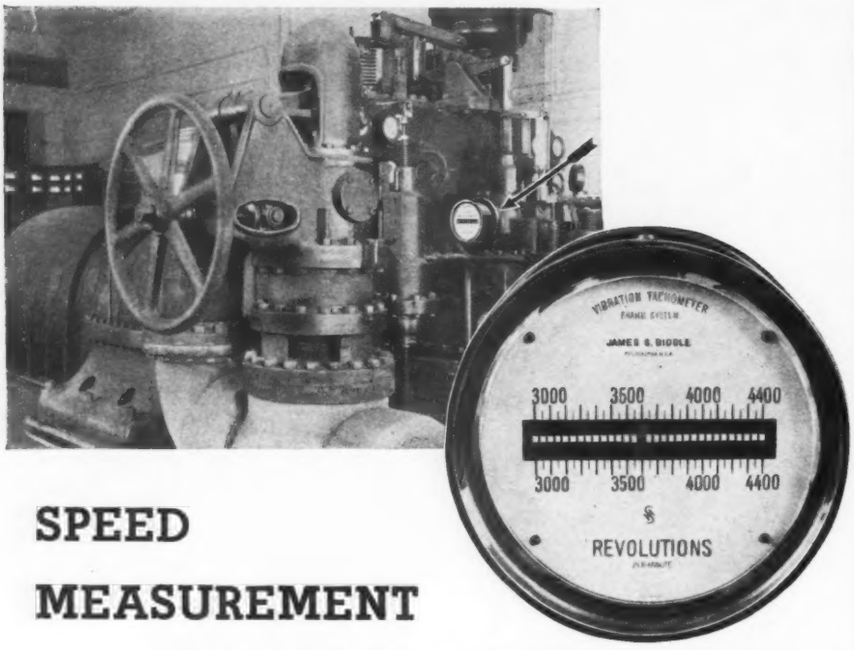
"FRAHM" TACHOMETERS



SPEED MEASUREMENT . . . WITHOUT BELTS, GEARS, ELECTRICAL CONNECTIONS OR ROTATING PARTS . . .

The sole mechanism in a Frahm Tachometer is a set of very accurately calibrated steel reeds. These reeds vibrate in tune with the slight vibration caused by the rotation of the machine on which the instrument is held or mounted. This *resonant vibration* of the reeds is clearly and instantly read on the scale as revolutions per minute.

There are no rotating parts in a Frahm Tachometer . . . nothing to wear, adjust or lubricate. The reeds hold original calibration indefinitely. The instrument is as rugged as it is simple . . . requires no mechanical or electrical connections. Simply mount or hold it on some convenient stationary part of the machine and the speed is indicated.

Let us tell you more about Frahm Tachometers. Write for your copy of new Bulletin 1510-W.

Frahm Vibrating-Reed Tachometers measure speeds from 800 to 30,000 r.p.m. . . . for use on turbines, generators, totally enclosed motors, very small motors, centrifuges, etc. They also accurately measure impulses (strokes) per minute in air hammers, drills, vibrators and similar mechanisms.

•

We invite inquiries about speed measurement problems . . . offer a complete line of high-quality, direct-indicating, centrifugal and chronometric instruments to meet many requirements . . . will be happy to consult with you and make recommendations.

JAMES G. BIDDLE CO.
ELECTRICAL AND SCIENTIFIC INSTRUMENTS
1211-13 ARCH STREET PHILADELPHIA, PA.

Economic Additions to Generating Capacity

[*Continued from page 41*]

the higher fixed costs of the more costly addition during the period before the load has grown sufficiently to require the full capacity of the addition. Where the additions are of nearly the same size and do not provide for more than a few years' growth in load, this effect will not be appreciable.

Because the comparative economy of the proposed additions in later years, after further additions of capacity have been made, must also be considered in making a proper selection, it is desirable to make determinations of system production costs for conditions existing after a second and possibly a third addition has been made. The second and third additions should for purposes of comparison be considered to be the same for the different plans of first additions. From the costs developed in these comparisons additional costs per kilowatt of additional reliable capacity provided by the additions to be compared can be developed in a similar manner to that above described, to reflect the relative economy of the different plans of first additions in the period after a second or third addition has been made.

Because generating capacity additions at different locations involve different losses in making the output available to the customers served, it is desirable to make cost comparisons in terms of the maximum reliable capacity that can be made available at the distributing substations rather than of the reliable capacity from the generating stations. Determinations should be made both of the kilowatt transmission losses at the time of the peak and of the annual transmission energy losses. Having these data for each addition considered, the amount of system load that can be reliably carried expressed in terms of output from the transmission lines can be readily determined. The annual energy output to be supplied from the transmission lines can then be arrived at by use of the assumed load factor of the load at this point, and the energy to be supplied from generating stations determined by adding the previously estimated energy losses in transmission.

The result of making the determina-

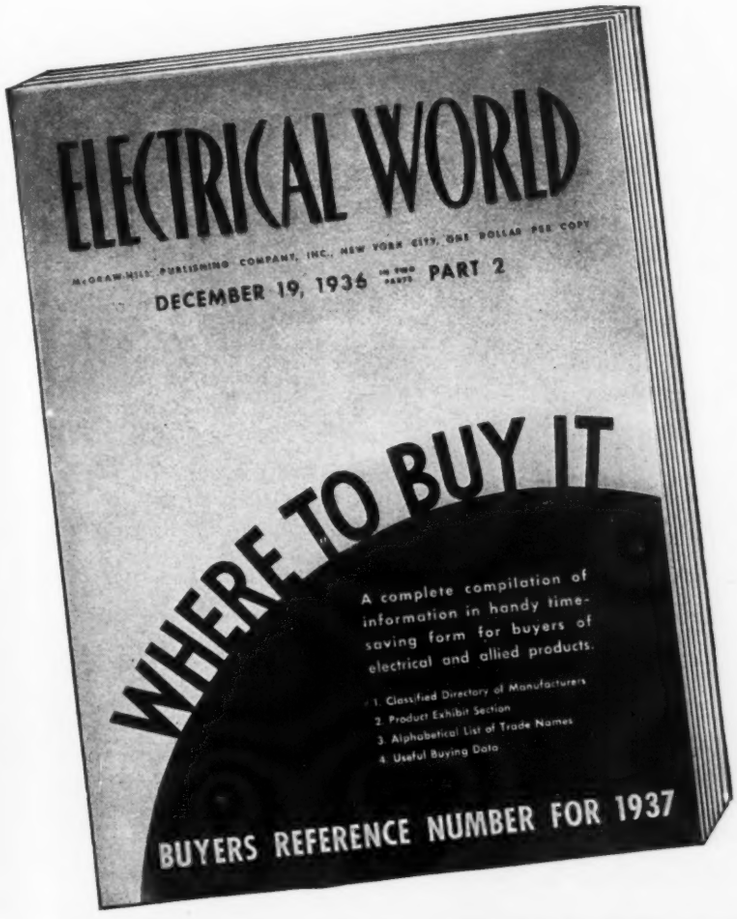
Here is a complete, handy index

of the electrical and allied products of some

3,300 MANUFACTURERS

Alphabetically arranged and supplemented, in many cases, by manufacturers advertisements giving detailed product information.

Keep this book handy — use it in planning your buying — it will save time and money for you!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McGRAW-HILL PUBLISHING COMPANY, INC., NEW YORK CITY, ONE DOLLAR PER COPY
DECEMBER 19, 1936 IN TWO PARTS PART 2
WHERE TO BUY IT
A complete compilation of information in handy time-saving form for buyers of electrical and allied products.
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The Electrical Buyers Guide for 1937!

●

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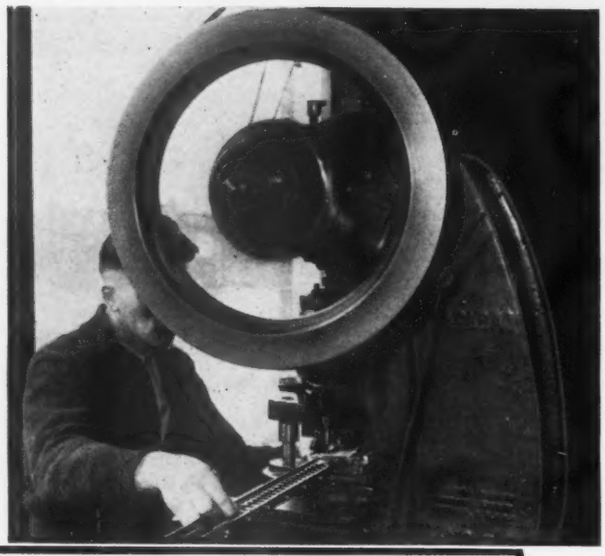
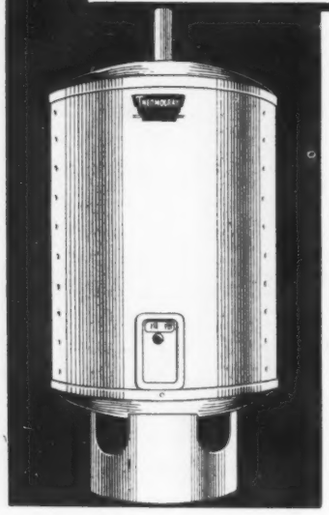


The resistor ribbon for all Thermogray heating elements is punched and formed at the Thermogray factory. All Thermogray heaters are factory-built throughout.

If You Are Interested in VALUE . . . -Not Costly Promotion BUY THERMOGRAY HEATERS



This is the Type D heater that is popular with leading utilities needing large heaters at a low price. Designed for off-peak heating and available in 65 to 148 gallon sizes. Large diameter tank reduces radiation heat loss. Assembly completed on the job.

For real dollar value, you can't do better than Thermogray electric water heaters. These complete factory-built units give years of economical, trouble-free, highly satisfactory service. Heavy insulation and proper baffling to prevent mixing of hot and cold water keeps the heated water at the right temperature for long periods. Factory-built quality, experienced engineering, and dependable performance make the Thermogray an outstanding heater in the field. In order to give you the finest quality at an attractive low price, the Thermogray Company has foregone the expense of a large sales force and extensive promotion. Your cost is based entirely on the quality of the product. Thermogray heaters are completely built—not just assembled—at the factory.

Electric water heater sales increased 34,000 units in 1936. This shows a rapidly broadening consumer demand for this type of equipment. Be prepared for the expansion in this field by merchandising reliable Thermogray heaters. Write for full details today.

THERMOGRAY CO.
307 W. McKINLEY STREET JEFFERSON, IOWA

Thermogray ELECTRIC WATER HEATERS

tions herein described will be to have made available, for each addition considered, values of additional annual cost per kilowatt of additional load which can be reliably served at the supply end of the system transmission lines. These unit costs will permit a comparison of the economy of the various additions to be considered, under conditions obtaining after a second and third addition of capacity has been made to the system as well as under the conditions existing before a second capacity addition is made. The final decision as to which plan of addition is the most desirable will have to be made by weighing the unit cost comparisons for the different future conditions and by giving consideration to other factors such as effect on reliability of service, voltage regulation, etc., which are not allowed for in the above comparisons.

•

April Output in Britain

Electricity generated in Great Britain in April by authorized producers totaled 1,832,000,000 units, compared with 1,554,000,000 units in April, 1936, an increase of 17.9 per cent, according to Assistant American Trade Commissioner Henry E. Stebbins, London, in a report to the Department of Commerce. During the first four months of the present year electric energy generated totaled 8,026,000,000 units, compared with 7,101,000,000 units in the corresponding period of 1936, an increase of 13.0 per cent, according to the report.

•

April Vacuum Cleaner Sales

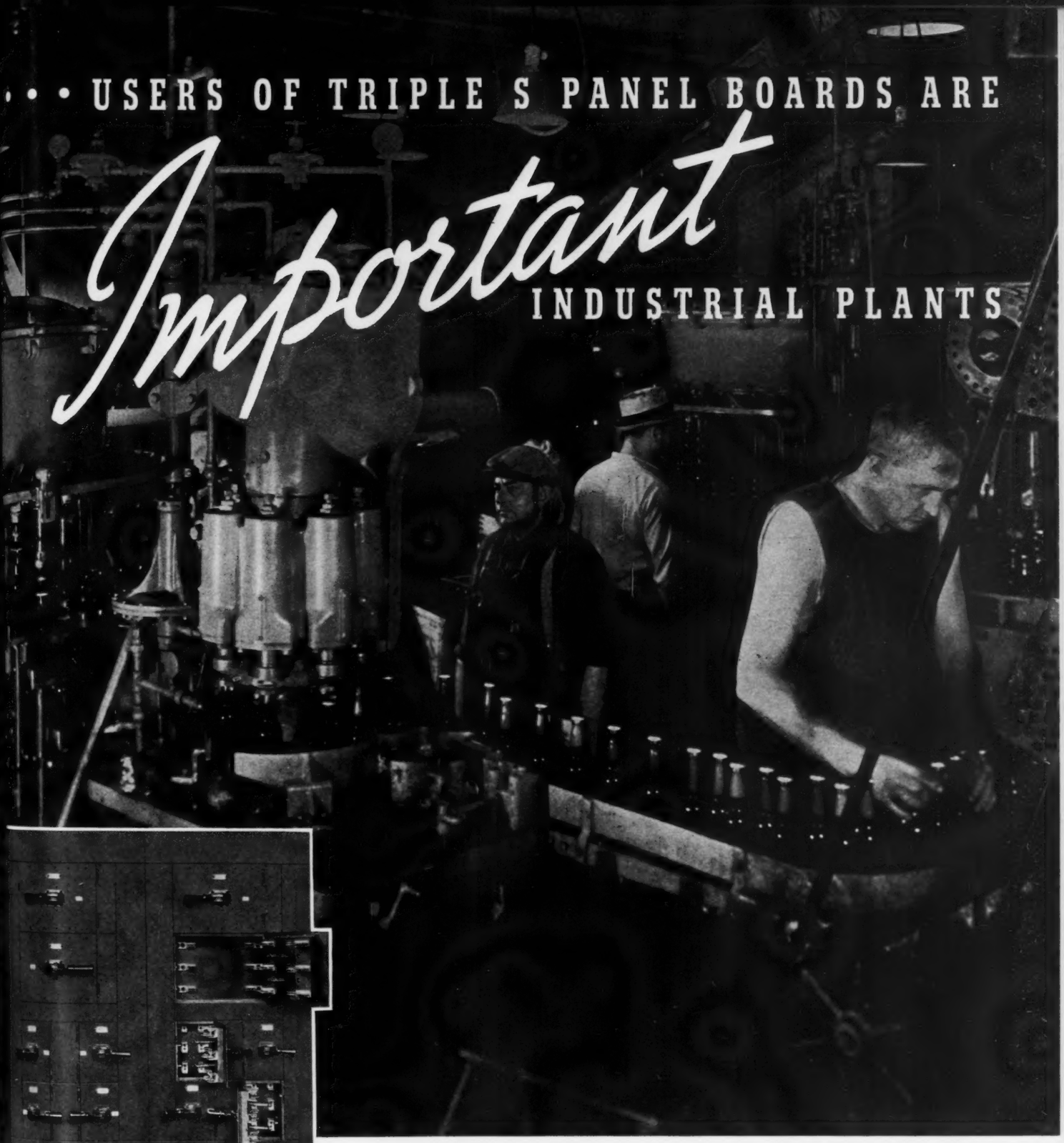
Announcement has been made by the Vacuum Cleaners Manufacturers Association that during the month of April floor cleaner sales totaled 140,516 units and hand cleaner sales 50,020 units.

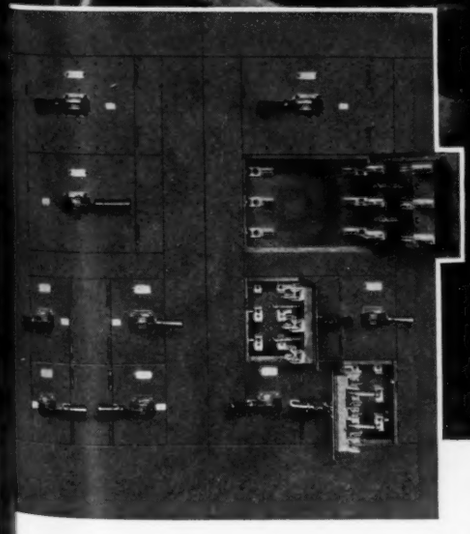
•

Lighting Contract Awarded

Contract for installing a new lighting system for thirteen city blocks in South Milwaukee, Wis., has been awarded by the Common Council to the Clifton Engineering Company, Pontiac, Mich. The contract price is $18,915 and ornamental lighting equipment manufactured by the Line Material Company will be used.

• • • USERS OF TRIPLE S PANEL BOARDS ARE *Important* INDUSTRIAL PLANTS





• As for instance, in Cleveland, Ohio, where every large brewery in operation uses **TRIPLE S** panel boards for operating their machinery. Shown above in the plant of the Brewing Corporation of America, domestic manufacturers of Carling's ale and beer, is very modern equipment controlled by a multiple **TRIPLE S** panel board—one for each of the twin bottling production lines.

From gravity conveyors, "empties" enter the washing and sterilizing machine, emerging into the bottling machine, thence after capping, entering the Pasteurizer where an hour at 140° Fahr. is required for sterilization, thence through labeling machines and past inspectors, bottle by bottle, to the packers. Production is 600,000 cases a month in this plant.

Switchboards and panel boards having the **TRIPLE S** name-plate are ample insurance for large and small plants of uninterrupted current supply from that point on, and their exclusive features for safety and efficiency make them a profitable investment. Power salesmen know that when **TRIPLE S** equipment goes on the line, troubles fly out the window. Built much better than seems necessary, but nearly 40 years of manufacturing experience dictates our specifications. Ask for engineering manual, just off the press.

Manufacturers of Safety Power and Lighting Panels, Knife Switches, Pull Boxes, Cutout Boxes, Cabinets and Switchboards

THE CLEVELAND

Switchboard

» » COMPANY « «

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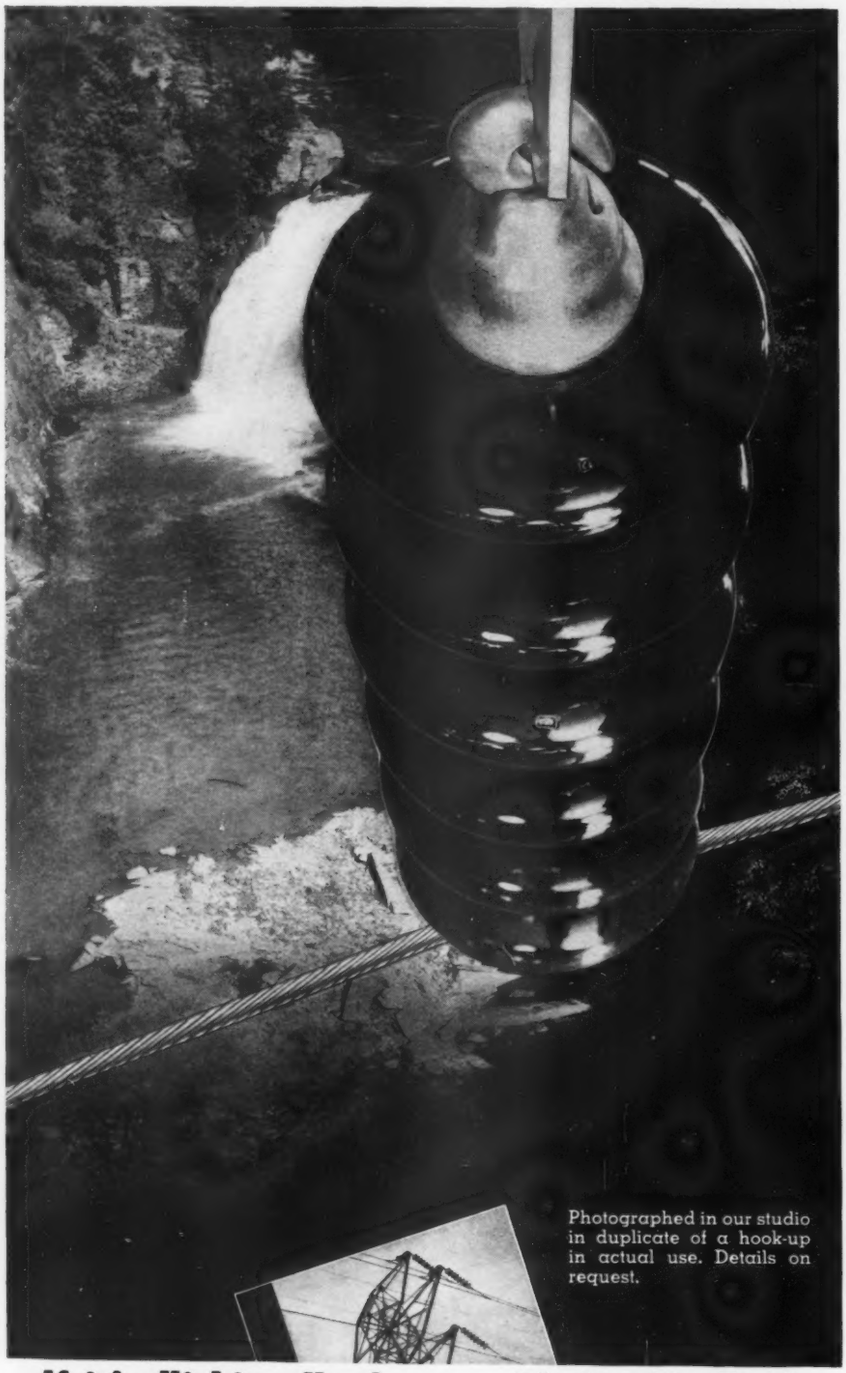
Hardware-BTC

Drop Forged Clamp No. 6204, Ball Hook No. 3001, Drop Forged Caps.



Photographed in our studio in duplicate of a hook-up in actual use. Details on request.

If it's Hi-Line Hardware - it's in this Book

. . . Sold through Your Insulator Mfr. Only

The Brewer-Titchener Corp.
Cortland, New York

Engineers Must Share in Continuing Property Records

[*Continued from page 45*]

"Specific Cost Method" is a method whereby the job cost is assigned to the unit or units installed on that job and thereafter this cost remains associated with each unit until retired.

Property with frequent turnover such as in the Electric Distribution System, the "Specific Method" of pricing is more flexible and is better adapted for effecting addition, retirements and compilation of statistics than is the "Average or Area Cost Method." The latter method has a useful application for certain properties dealing with similar kinds of units but where the turnover is infrequent.

The Continuing Property Records for Inside Plant property—that is, structures, mechanical and electric station equipment—have in general been established on the "Specific Cost" base because of the many dissimilar units and groups of units making up the various operating installations.

The engineer has a definite interest in accounting problems for the reason that without correct factual reports the correct accounting would certainly not be carried out, thus creating a tendency gradually to pyramid and inflate the cost of the plant.

•

Lets Power Plant Contract

Contracts for equipment for the new power plant to be built at Reeve, Iowa, have been let to the Nordburg Company, Milwaukee, for $189,000 by directors of the Federal Co-operative Power Association.

•

Air Conditioning System

An air conditioning system which allows guests to regulate inside weather will be installed in the George Washington Hotel at Jacksonville, Fla., by the Carrier Corporation. Cost of the equipment and installation work will be approximately $100,000, according to Robert Kloeppel.

•

Bids on Lighting Equipment

New York State Gas & Electric Corporation has made an offer to purchase for $88,279 all city-owned street lighting equipment, including underground conduits, in the city of Binghamton, N. Y.

COLLECT ALL *that's* COMING *to you*

It's due now, and it pays you handsomely for your interest

CLIP THE COUPON BELOW

THIS is an out-and-out offering of a high class investment—a proposal that you collect the return on the money that Whitehead has plowed into *your* markets. For your profit and advantage. *Mail the coupon.*

Ten million people who make up the cream of American buying power—that's the market cultivated by advertising which features Whitehead Work-Saving Kitchens. These people know Whitehead as the only maker of complete kitchens, with steel base-cabinets topped with Monel . . . and more of them are modernizing homes this year than in any year since '29! Like a mighty dynamo, swirling with pent-up energy, this market is ready to make its force felt for *you*, if you will "click the switch". *Mail the coupon!*

Turn leads into live wires. Make old contacts come to life. Re-open doors that were once closed to your salesmen. This free book shows *how*. Explains *why*. And suggests *when* . . . RIGHT NOW *Mail the coupon!*

The Whitehead Metal Products Co. of New York, Inc., 304 Hudson St., New York, N. Y., believes it will pay any merchandise-minded executive in the electrical industry to send for and read *"Yours if you Click it"*. Moreover, the company will pay the postage on your copy and all other costs of its preparation and forwarding, and further promises to make the contents full of a *high rate* of interest. So sign your name and address below and hound your mail clerk until "Yours if you Click it" is placed into your hands!

Name.....

Address.....

City..... *State*.....

MAKE OF MAJOR ELECTRICAL APPLIANCES HANDLED ★

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METAL PRODUCTS CO., OF NEW YORK, INC.
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BUILD for PERMANENCE with THOMAS INSULATORS

THOMAS—*Two Part Pin Type*—No. 2124
Rating 45 Kv.

Dry Flashover 125 Kv.
Wet Flashover 85 Kv.

Leakage Distance 21 inches
Mechanical Strength 3,000 lbs.

The demand for uninterrupted service requires permanency in line construction. Thomas No. 2124—a rugged two part pin type insulator of proven design has all the characteristic high qualities of Thomas Porcelain which give perfect service under all conditions . . . fine balance in design, ample porcelain thickness, ruggedness of flange, spaciousness of wire groove and many other quality features . . . all of which have been proved by years of faithful line service.

Introduced in 1919 there are now hundreds of thousands doing perfect line duty today. With not a single reported failure they are truly representative of Thomas Reliability—Long Life—and Economy.

"Specify Thomas No. 2124 for your next 33 Kv. line."

To those preferring Thomas One Piece Porcelain Construction we offer the more recently designed No. 1924. Rating—45 Kv. Dry flashover—125 Kv. Wet—85 Kv. Leakage distance 20 inches. Mechanical strength—3,000 lbs.

THOMAS—*One Piece*—No. 1924

THE R. THOMAS & SONS COMPANY
ENGINEERS - MANUFACTURERS - DESIGNERS
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Recent Rate Changes

NORTHERN STATES POWER COMPANY has been ordered by the Wisconsin Public Service Commission to cut its electric rates $245,500 annually. The reduction is made up of a 10 per cent cut of $100,000 to home users, a 16 per cent cut of $110,000 for commercial lighting, $11,000 for commercial cooking and heating customers, $21,000 to eight wholesale customers including six municipal utilities, and $3,000 to farm customers. The cut becomes effective after June meter readings.

MILWAUKEE ELECTRIC RAILWAY & LIGHT COMPANY has been ordered by the Wisconsin Public Service Commission to reduce rates to 23,490 commercial users $161,000. In addition to the commercial users affected, 1,800 rooming houses will be affected. This reduction also becomes effective after June meter readings.

CALIFORNIA RAILROAD COMMISSION has approved an annual reduction of $659,000 in the electric rates to commercial and domestic consumers, of the Southern California Edison Company. Domestic customers will get the benefit of $456,000 or about 70 per cent of total reductions and commercial users will share the other 30 per cent, or $203,000 of the annual rate cut.

NEW YORK STATE GAS & ELECTRIC CORPORATION has filed with the Public Service Commission a new schedule reducing domestic electric rates $170,000 in the Binghamton area. The new rate schedule, effective July 1, eliminates the "demand or fixed charge," based on customers' number of rooms, and will apply to Binghamton, Johnson City, Endicott, Owego, Afton, Windsor, Whitney Point, Newark Valley and adjacent territory. The new rates follow: first 12 kw.-hr. or less, $1; next 28 kw.-hr., 5 cents a kilowatt-hour; next 60 kw.-hr., 3½ cents a kilowatt-hour and over 100 kw.-hr., 2 cents a kilowatt-hour.

WISCONSIN PUBLIC SERVICE COMMISSION has received applications from five major utilities, asking for establishment of the temporary bargain rate as the standard residential rate schedule. Companies filing the petitions and the estimated savings are as follows: Wisconsin Power & Light, $160,000; Northern States Power, $100,000; Wisconsin Public Service and its subsidiary, the Menominee and Marinette Light & Traction, $88,000 and the Lake Superior District Power, $22,000.

NORTHAMPTON ELECTRIC LIGHTING COMPANY has proposed an electric rate reduction for customers in Northampton, Goshen and Williamsburg, amounting to $10,115. Hearing was held recently before the Massachusetts Public Utilities Commission. The proposed schedule gives commercial customers in Northampton an annual saving of $8,841.

ENDICOTT, N. Y.—Revised electric rates have been approved by the state Public Service Commission. The new schedule effects an annual saving of $10,000 for residential consumers.

MINNESOTA POWER & LIGHT COMPANY has been granted a ten-year franchise in Little Falls by an eight to one vote of the City Council after five months of hearings and executive meetings. Lower rates on commercial lighting, retroactive from December 1, will go into effect thirty days after publication of the franchise ordinance.

OZARK UTILITIES COMPANY'S electric rates at Greenfield and Miller were found not excessive by the Missouri Public Service

Commission which denied application of city officials for a reduction. Voluntary rate cuts have already been made, the report stated.

CONCORD, N. C., LIGHT & WATER DEPARTMENT has announced an average reduction of 12 per cent in electric rates, effective on June 1 bills. The reduction will represent a savings of approximately $1,500 per month to customers of the light and water department. Mayor W. A. Wilkinson stated that an increase in the use of electricity justified the rate reduction.

CANTON ELECTRIC LIGHT & POWER COMPANY has filed schedules of reduced commercial and power rates with the New York Public Service Commission. It is estimated that customers will save $4,600 annually.

•

Chile Plans to Electrify

Reports from Chile indicate that the government is considering plans for the general electrification of the country, with the construction of numerous hydro-electric plants to supply power and light to all cities and towns. It is estimated that 1,000,000,000 pesos (approximately $50,000,000) will be spent in putting the plan into effect, although details have not been announced.

•

Illinois Town to Be Served

Ellery, the only town in Edwards County, Illinois, now without electricity, will have this service before the close of the summer, according to an announcement by officials of the Central Illinois Electric & Gas Company. The Illinois Commerce Commission has approved the application of the utility to build an electric line into that town.

•

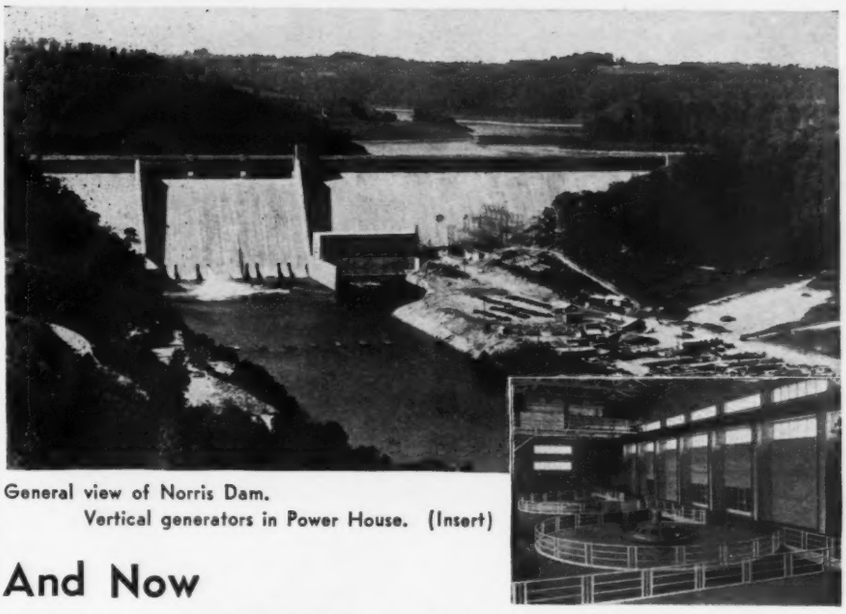
Plan Electricity Courses

Three courses dealing with the physical and chemical phases of electricity will be given during the 38th summer session of Columbia University, which opens its six-week term on July 12. Courses will be given by Dr. C. B. F. Young, Dr. D. P. Mitchell, Dr. W. H. Barkas and Dr. J. H. Manley.

•

Plans New $225,000 Plant

McGraw Electric Company has plans maturing for a new one-story and part basement plant at Elgin, Ill., brick and steel type, estimated to cost close to $225,000, with equipment. Bids will be asked on general contract for erection in the near future. Olsen & Urbain, Chicago, are archi-



General view of Norris Dam.
Vertical generators in Power House. (Insert)

And Now
NORRIS DAM

(Below) Lux system protecting Power House from fire.

is LUX-PROTECTED

IN a setting of startling beauty the T.V.A. has constructed one of the truly great modern hydroelectric power plants. Keeping pace with up-to-date design T.V.A. has also installed a fully electric automatic LUX fire protection system with emergency remote control. This system, consisting of twenty 50 pound capacity cylinders with an additional connected reserve of similar capacity, protects not only the two giant 66,000 H.P. vertical generators but also an oil storage room and an oil purifier room. The generators automatically operate the system from differential relays and fixed temperature thermostats in the exhaust air duct.

The Wheeler Power plant is similarly protected by a LUX system and both developments have the added protection of quite a few portable LUX units.

Employing the dry harmless gas—carbon dioxide—LUX systems swing into action at the first flash of heat and three seconds later fire cannot exist. Let us send you our new descriptive booklet "Smothering Fire in Power Plants."

Walter Kidde & Company
60 West St., Bloomfield, N. J.

FOR ALL ELECTRICAL AND FLAMMABLE LIQUID FIRES

TYPE "RT"

Distinguishing features are (a) the round tank, and (b) the high-tension and low-tension co-ordinated stud type bushings brought out through pockets.

TYPE RT, like all Pennsylvania Distribution Transformers, has the CIRCULAR open-type coil, balanced radially and axially against short circuit stresses and treated in varnish which does not soften under high temperatures nor contaminate oil.

Typical of Pennsylvania's unvarying high standards, this transformer offers the maximum in service, safety and economy.

Pennsylvania Transformer Co.

701 Island Ave.

N. S., Pittsburgh, Pa.

PENNSYLVANIA TRANSFORMERS

Municipal Plants

VERNON, CALIF.—Approval has been granted by the California Railroad Commission to a lease agreement between the Southern California Edison Company and the city whereby the Edison company takes over the operation of the Vernon municipal distribution system and diesel engine plant. Under the terms of the lease the Edison company will pay interest and redemption charges on the bonds issued to build the system together with a 2 per cent levy on the gross less any franchise taxes which might be imposed. The municipal distribution system will be interconnected with that of the Edison company and power will be supplied from the Edison hydro and steam plants, including Boulder Dam, when the company's line to that plant is completed. The lease is to run for a term of ten years with an option to renew it for a similar interval. It specifies that Vernon rates shall be kept on a parity with those of the Los Angeles Bureau of Power and Light.

BOONVILLE, IND.—The $2,400 additional appropriation measure, passed by the City Council to carry on the electric utility contest in court, has been approved by the State Tax Adjustment Board at Indianapolis. The measure was opposed at a recent hearing. About a year ago a special election was held in Boonville at which time the voters approved the proposition of taking over the electric light plant of the Southern Indiana Gas & Electric Company. The approval of the $2,400 appropriation was made by the State Tax Adjustment Board on the condition that this amount be included in the total cost of the plant and be returned to the general fund from the sale of revenue bonds, if the condemnation proceedings were successful. The Southern Indiana Gas & Electric Company through its attorneys has filed objections to the condemnation suit. Attorneys for the utility company contend that the citizens of Boonville had been told that the taxpayers would not bear the expense of taking over the light plant and that a bond issue would be floated. If the condemnation proceedings were not successful, it was contended that the $2,400 apropriation would have to be met by the taxpayers. Proponents of the measure declared that the company's refusal to accept their offer had led to court litigation, thus creating an emergency involving the additional appropriation to carry on the fight to gain control of the utility.

PRIMGHAR, IOWA—Construction of a municipal light and power plant not to cost more than $125,000 was approved by the citizens by a vote of 318 to 99 in a special election held recently. The franchise of the Iowa Public Service Company expires August 1, 1938.

DESHLER, NEB.—Attorneys for the village have asked the state Supreme Court to affirm the order of the district court ordering the Southern Nebraska Power Company to remove its distribution system, including poles and wires from its streets and alleys. The village claims that in the previous litigation the courts held that the company has no valid franchise and that therefore the continued occupancy of its thorofares constitutes a public nuisance.

MYERSTOWN, PA.—The borough of Myerstown in Lebanon County and the Public Utility Commission have joined in petitioning the State Supreme Court to allow an appeal to it from the judgment of the Superior Court which reversed an order of

the commission authorizing the borough to build and operate a municipal electric plant. The original application was protested and later an appeal from the order of the commission to the Superior Court was made by the Metropolitan Edison Company, which operates in the borough. The order was reversed by the court on April 26 and the case remanded for further hearing. The commission declares in its petitions that the court provide a "clear and deliberate course for future cases."

SOMERSET, KY.—A report of city council's light and power committee, recommending that the question of a municipally owned light and power plant be submitted to the voters at the November election, has been adopted recently by a vote of 4 to 2. The city attorney was authorized to prepare the the necessary ordinance for calling the election. The report was presented by Councilman L. F. Guffey. Argument in opposition to adoption of the report was made by J. H. Bailey, Pineville, district manager of the Kentucky Utilities Company, which now serves the city.

ST. CHARLES, MO.—A new move was started recently for municipal control of electric power distribution. Mayor Charles Kansteiner was authorized at a meeting of the city council to appoint a committee to confer with officials of the Union Electric Company concerning the purchase of power at wholesale rates by the city for distribution among its residents. Councilman Wesley Filling, who started the action, expressed the opinion the project, if consummated, would enable the city to furnish electricity to the residents at rates lower than the existing ones. Councilmen were of the opinion that the proposal, if carried out, would ultimately result in purchase of the equipment of the Union Electric Company in St. Charles by the city. Residents in 1934 defeated in two special elections proposals for the purchase of an electric power plant by the city. The new move is different, it was said, in that the city would buy power instead of producing it.

LAKEWOOD, OHIO—City Council has passed a resolution authorizing its public utilities committee to negotiate with Cleveland officials, investigating the feasibility of obtaining light from the Cleveland municipal plant. The franchise between Lakewood and the Cleveland Electric Illuminating Company has expired and the city is forced either to renew the franchise or seek electricity for domestic use from some other source. The resolution stated the city for many years has been in the embarrassing position of being compelled to accept any rate the company cared to offer. Council President William H. Fahrenback, who instigated the action, told the members that Cleveland Utilities Director Frank O. Wallace had informed him that the present size of the light plant would not allow the service, but that with expansion it might be possible.

•

Electric Sales in Illinois

Comparison of sales of electricity in Illinois to ultimate consumers in April, 1937, with those of April, 1936, as reported by twelve large companies (representing 99 per cent of the total electric business), reveals increases in revenue of 9.1 per cent, kilowatt-hours 14.9 per cent and consumers 2.8 per cent.

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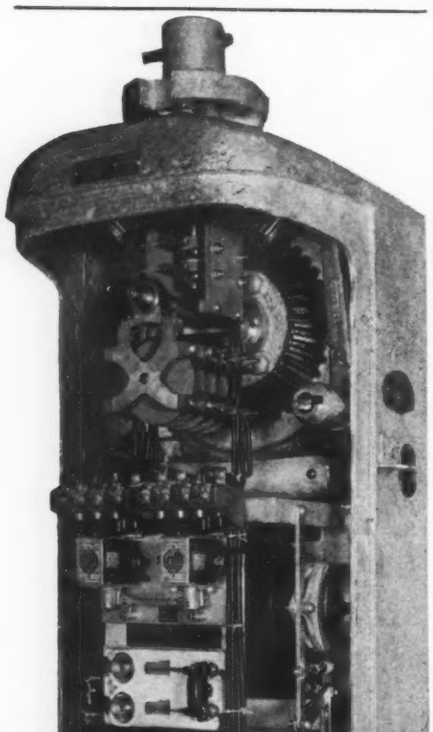
MOTOR MECHANISM
for
Tortion Type Switch Operation



"Essentially a Quality Product . . . . therefore ELPECO"

NOT an assembly of built-up parts BUT EACH PART BUILT for maximum efficiency, life and strength.

All parts mounted on frame which can be removed by taking out four bolts.

Use coupon for the NEW ELPECO CATALOG

Electric Power Equipment Corp.
412 North 18th St., Philadelphia, Pa.

Please send your NEW catalog to this address.

Name .....

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Sales Opportunities

PITTSBURGH, PA.—Duquesne Light Company has plans maturing for extensions and improvements in local steam-electric generating station, including installation of new 60,000-kw. turbo-generator unit, high-pressure boilers and auxiliary equipment. Transmission and distributing lines will be extended in connection with project.

WEBSTER CITY, IOWA—Receives bids until July 5 for extensions in municipal electric power plant, including 2000-kw. turbo-generator unit, with condenser and auxiliary equipment; 30-kw. non-condensing, steam-turbo exciter unit, and miscellaneous equipment. Also for addition to present power house building. Entire project will cost close to $132,000. E. R. Compton is city manager.

INDIANAPOLIS, IND.—International Harvester Company, 606 South Michigan Avenue, Chicago, Ill., plans installation of motors and controls, transformers and accessories, switchgear, electrical hoists, regulators, conveyors and other equipment in new motor truck manufacturing plant on Brookville Road, Indianapolis, where tract of land has been selected. Plant will total about 340,000 square feet of floor space. A steam-electric power station will be built. Entire project will cost close to $3,500,000. Company engineering department will be in charge.

KNOXVILLE, TENN.—Direcor of Purchases, Tennesee Valley Authority, receives bids until June 23 for 161-kv. oil circuit breakers for power plant at Pickwick Landing dam.

DENTON, TEX.—Denton County Electric Co-operatives, Inc., Denton, H. P. Keiner, secretary, receives bids until June 22 for primary and secondary lines for rural electrification in parts of Denton, Cooke, Collins and Grayson Counties, totaling about 550 miles, including poles, pole fixtures and fittings, wire and cable, transformers and accessories, service facilities, etc. Cost estimated close to $550,000. William G. Morrison, Professional Building, Waco, Tex., is consulting engineer.

BLUFFTON, OHIO—Central Ohio Light & Power Company, Findlay, Ohio, has plans maturing for proposed new steam-electric generating plant at Bluffton, recently referred to in these columns, and will ask bids at early date. Installation will include a 10,000-kw. turbo-generator unit, high-pressure boilers and auxiliary equipment. Company will also make extensions in transmission lines for connection with present main system. Cost about $1,200,000. Financing has been arranged. Sargent & Lundy, 140 South Dearborn Street, Chicago, Ill., are consulting engineers.

LOS ANGELES, CALIF.—Johns-Manville Corporation, 22 East Fortieth Street, New York, N. Y., plans installation of motors and controls, regulators, transformers and accessories, conveyors, electric hoists and other equipment in new branch plant at Watts, near Los Angeles, for manufacture of rock wool insulation specialties and kindred products. Work is scheduled to begin soon. Cost about $1,000,000.

ANNAPOLIS, MD.—Bureau of Yards and Docks, Navy Department, Washington, D. C., receives bids (no closing date stated) for extensions and modifications to electric system at Naval Academy, Annapolis, including secondary feeders and secondary mains, switchboards, distribution panels,

ROME-CABLE
ROME, N.Y.

U. R. C.
Weatherproof Wires and Cables

SOLID
STRANDED
SOFT
MEDIUM HARD
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TRIPLE BRAID

SIZES
From 12 A.W.G.
to
2,000,000 C.M.
Packages
COILS
or
REELS

Write for samples and prices.

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•

SALES OFFICES:
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branch circuits and complete auxiliary apparatus, including lighting fixtures (Specifications 8469).

CHEROKEE, OKLA.—Alfalfa Electric Co-operative, Inc., recently organized, has authorized immediate plans for primary and secondary lines for rural electrification in parts of Alfalfa, Grant, Garfield and neighboring counties, totaling about 320 miles, with outdoor power substation and service facilities. Bids will be asked in near future. Fund of $310,000 has been secured through Federal aid.

DUBUQUE, IOWA.—Interstate Power Company, Dubuque, plans extensions in transmission and distributing lines in parts of Clayton County. Application has been made for permission.

BLACKWELL, OKLA.—Has plans under way for expansion and improvements in municipal electric power plant, including installation of new 4000-kw. turbo-generator unit and auxiliary equipment. Black & Veatch, 4706 Broadway, Kansas City, Mo., consulting engineers, are making surveys and estimates of cost.

WASHINGTON, D. C.—Bureau of Supplies and Accounts, Navy Department, Washington, receives bids until June 22 for turbo-generator sets, switches and auxiliary equipment (Schedule 751).

READING, PA.—Parish Pressed Steel Company, Reading (Division of Spicer Manufacturing Company, Toledo, Ohio), plans installation of motors and controls, loaders, electric hoists, conveyors and other equipment in new addition to mill. Cost over $125,000.

CHARLOTTE, N. C.—Duke Power Company, Charlotte, plans primary and secondary lines for rural electrification in Northern part of Iredell County, totaling about 40 miles, with power substation and service facilities. Right-of-way is being secured. Cost estimated close to $50,000.

BRAINERD, MINN.—Crow Wing Cooperative Power & Light Company, Brainerd, E. T. O'Brien, secretary, will take bids soon for primary and secondary lines for rural electrification system in parts of Crow Wing and Morrison Counties, totaling about 210 miles, with outdoor power substations and service facilities. Power will be secured from municipal station at Brainerd. Cost estimated close to $240,000. Financing has been arranged through Federal aid. Harold Bliss is company engineer.

PASADENA, TEX.—Champion Paper & Fibre Company, Houston Division, plans installation of motors and controls, regulators, transformers and accessories, loaders, conveyors and other equipment in new addition to local sulphate pulp mill, comprising several units, estimated to cost about $1,500.000. J. E. Sirrine & Company, Greenville, S. C., are consulting engineers. Main offices of company are at Hamilton, Ohio.

PHILADELPHIA, PA.—Philadelphia Electric Company has taken out a permit for proposed three-story addition to Schuylkill steam-electric generating plant, previously referred to in these columns, estimated to cost about $5,000,000. Work on foundations, estimated to cost about $59,000, will be placed under way. Installation will include a 50,000-kw. turbo generator unit and auxiliary equipment. Work is scheduled for completion in fall of 1938.

BOSTON, MASS.—Bureau of Supplies and Accounts, Navy Department, Washington, D. C., receives bids until June 22 for diesel-electric propelling plant and auxiliary equipment, for Boston Navy Yard (Schedule 864).

THE MATERIAL OF COUNTLESS APPLICATIONS

DIAMOND VULCANIZED FIBRE—an insulating material—has good electrical qualities. It combines light weight with great mechanical strength and excellent machining qualities. It is a comparatively inexpensive material. It is widely used throughout all industry because it performs many duties more efficiently and more economically. It is made in standard sheets, rods and tubes and can be furnished in fabricated or formed parts to meet your specifications.

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Here is a portable tool that is simple and easy to operate, yet it bends conduit quickly, making smooth even bends on any size within its range. Hydraulic pressure, set up by pumping the handle, does the bending. And its operation is just as simple as the picture indicates.

Above is the Greenlee Rigid Conduit Bender in use. It is made in two sizes for conduit from 1¼ to 3-inch and from 2¼ to 4½-inch. The small bender can be fitted with special attachments for bending thin-wall steel conduit in 1¼, 1½ and 2-inch sizes.

Complete information on Greenlee Conduit and Pipe Benders will be sent gladly. Tell us what you want to bend.

GREENLEE TOOL CO., 1705 Columbia Ave., ROCKFORD, ILL.

To Reconstruct Dam

Wisconsin Public Service Corporation has filed with the Federal Power Commission its declaration of intention to reconstruct the existing timber and rock-filled crib dam across the Wisconsin River at Tomahawk, Lincoln County, Wis., and to construct a power plant and substation.

The power house, located at the west end of the dam, will have an installation of two vertical units of 2,000 hp. capacity each, operating under a net head of 16 ft. A 3,000-kva. substation will connect the plant with the company's transmission system.

•

Hotel Abandons Own Plant

The Curtis Hotel in Minneapolis, Minn., one of the largest of the Northwest hostelries, after experimenting over a two-year period with its own electric plant, has decided to return to the central station service and has arranged with the Minneapolis General Electric Company, a wholly owned subsidiary of Northern States Power Company (Minn.), for the purchase of approximately 1,000 hp. in lighting and power service.

•

Cleaner Sales Net $266,000

The Electrical Association of Philadelphia concluded recently the most successful electric cleaner campaign ever sponsored locally on this appliance. During the campaign period, from March 22 to April 24, 5,515 electric cleaners with an average retail value of $48.34 each, were sold by the nineteen participating manufacturers, distributors and the utility company. The electric cleaner activity has been an annual Spring promotion by the Association for the past five years. Units sold had a retail value of $266,000.

•

Worthington Stock Exchange

Worthington Pump & Machinery Corporation has offered for exchange two series of a new cumulative prior preferred stock and additional shares of its common stock to holders of its present Class A 7 per cent and Class B 6 per cent prefered stocks. A registration statement filed with SEC has become effective recently.

POWER TRANSFORMERS

38 **Bulletin No. 340. Pennsylvania Transformer Co., Pittsburgh.** Contains photographs of large transformers, single- and three-phase, used for power transmission, electric arc furnaces, railway systems and other industrial uses. One section is devoted to improvements in distribution transformers.

WOOD POLE PRESERVATION

39 **"Osmose Process for Wood Preservation," 24 pp. Osmose Corp., Buffalo, N. Y.**—Following a discussion of wood decay and preservation, the Osmose process for green wood, for groundline treatment is presented in some detail, with results of such treatments included.

PHOTO-REPRODUCTION

40 **Folder on Opaque typewriter ribbon. Ozalid Corp., New York.** Announces a new typewriter ribbon developed for photo-reproduction of typewriting, or for making master copies from which Ozalid White Prints may be made.

CAPACITORS

41 **Catalog 139A; Cornell-Dubilier Corp., South Plainfield, N. J.** Describes in detail the new pole type capacitors for power factor correction of distribution systems recently announced by this company.

RURAL LINE CUTOUTS

42 **Bulletin 215-B; leaflet. Schweitzer & Conrad, Chicago.** Describes and illustrates the new rural line Type "MO" cutouts for transformer installations. Diagrammatic drawings give dimensional data, show various mounting arrangements.

DIESEL ENGINE

43 **Publication AOB 202-11. Fairbanks, Morse & Co., Chicago.** Devoted to description of a new Diesel, Model 42-E, developed as a small engine for heavy duty stationary use. Two- and three-cylinder combinations with ratings of 60 and 90 hp. are offered.

EXPANSION JOINTS

44 **Bulletin X-37-4. Foster-Wheeler Corp., New York.** Describes briefly the forms available for a new type "S" stainless steel bellows expansion joint, for pressures up to 150 lb. per sq. in.

FLEXIBLE METAL TUBING

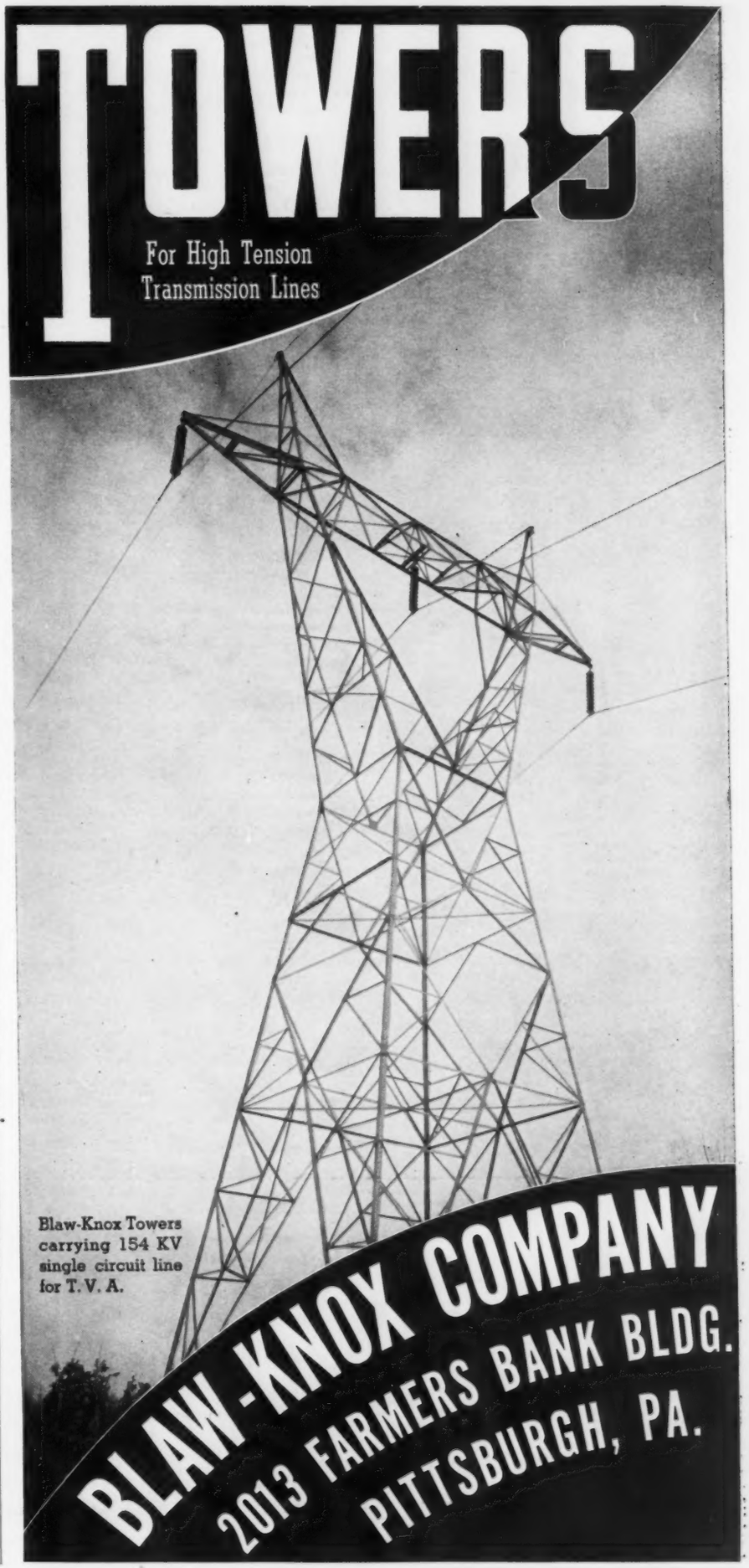
45 **Bulletin SS-3; 16 pp. The American Brass Co., American Metal Hose Branch, Waterbury, Conn.** Covers "American" seamless flexible metal tubing, discussing the construction, advantages, applications, installations and types offered.

FIRE ALARM SYSTEMS

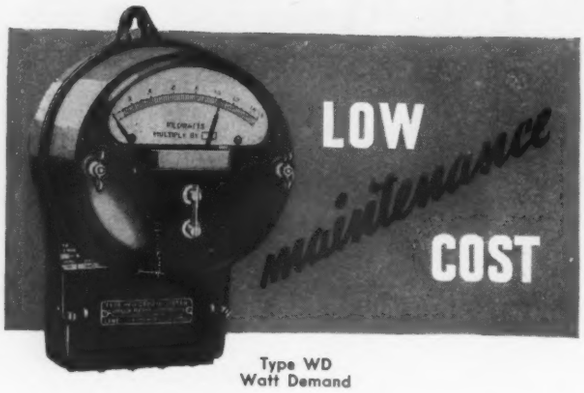
46 **Bulletin No. 102; 16 pp. S. H. Couch Co., North Quincy, Mass.** Shows the various equipment in some of the "Samson" fire alarm systems and includes wiring diagrams for various systems.

ROOFING AND SIDING

47 **"J-M Corrugated Transite"; 12 pp. Johns-Manville, New York.** A page of drawings show construction details of applying Transite Installation pictures showing its application to industrial roofing and siding are also shown.



LINCOLN DEMAND METERS



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SC-6X

SEND FOR TRADE BULLETIN No. 22

H. B. SHERMAN MFG. CO.
BATTLE CREEK, MICH.

BOOK REVIEWS

Alinement Charts: Their Construction and Use

By Paul N. Lehoczky. Published by Engineering Experiment Station (Circ. No. 34), Ohio State University, Columbus, Ohio. 62 pages, illustrated, pocket chart. Price, 40 cents.

Alinement charts are classified into three groups and it is shown how to break complex equations so the modified form will fall under one of the three types. It is then shown how to construct the nomogram or alinement chart for many uncomplicated relations. The pamphlet is most direct and useful for those who are not ready to follow the comprehensive treatment in the books by Lipka and by Hewes and Seward.

•

Annual Tables of Electricity Undertakings

Published by Benn Brothers, Ltd., Bouverie House, Fleet Street, London, E. C., 4. 242 pages Price, 10 shillings, net.

In compact form, this edition, like its long line of precursors, gives a mass of detailed data nowhere else assembled on electricity supply in every place in Britain which has a supply of any significance, in the more important centers in the Empire, and in a considerable number of foreign cities throughout the world. Aside from the systems of supply, consumers' voltages, prices of current, addresses of head offices and showrooms and similar information of interest to the supplier of electrical apparatus, technical details of interest to engineers and manufacturers are listed. These include number of consumers, generating and transmitting voltages, generating and steam-raising plants. A separate section, devoted to the Grid System, gives various particulars of areas, selected stations and a map of transmission lines.

•

Instrument Transformers

By B. Hague. Published by Pitman Publishing Company, New York. 634 pages, illustrated. Price, $10.

Great as will be the technical reception of this book, its worth in averting the reinvention of long-standing but hidden methods of designing, improving, testing and applying instrument transformers will surpass it. The author has brought to light in this compendium the international literature in such balanced and comprehensive degree as to comprise the major authentic source in English of instrument transformer technology. While emphasis is at all times on principles, there is ample inclusion of subject matter from the field of commercial availability and practice.

Five parts deal with theory, test apparatus, test methods for current transformers and voltage transformers, ratios and phase angles, with a final section of dielectric and temperature and other tests. The first part gives a good résumé of national requirements over the world, design as based on theory and characteristics of magnetic alloys, along with the correctives devised to approach ideal performance of instrument transformers; here also are treated the multirange and totalizing current transformers and the thermal and mechanical consequences of short circuits and surges. Com-

parable treatment of the voltage transformers follows and then their combined use in power and energy measurements.

Part II first treats in generous fashion the standard accessories on which the testing techniques are founded (resistors, inductors, capacitors and a.c. potentiometers). Parts III and IV in dealing with the methods for determination of ratio and phase angle for both current and voltage transformers segregates them into indirect, absolute deflectional, absolute null, relative deflectional and relative null. Part V contributes the supplementary tests of dielectrics, polarity and thermal performance. One appendix tabulates four place correction factors for power measurement at five-minute intervals of phase angle; another treats capacitor dividers for high-voltage measurements; a third offers a bibliography supplementing the multiplicity of references throughout the book to original sources.

Presentation is lucid and scholarly. No designer, researcher or user concerned with accuracy and adequacy of instrument transformers can afford to be without this book unless he is willing to duplicate the author s painstaking collection and collation of the world literature of the art.

•

Two New N.E.M.A. Standards

Published by National Electrical Manufacturers Association, 155 East 44th Street, New York, N. Y.

Household Electric Refrigerator Standards. Publication No. 37-41, March, 1937. Price 40 cents. Sections on computation of volumes and shelf areas, test conditions, no-load test, ice-making test, thermometer location and uniform reports.

Indicating Electrical Measuring Instruments; Instrument Transformers. Publication No. 37-42, April, 1937. Price, 60 cents. Gives commercial, general, rating and manufacturing standards. Covers performance specifications, physical dimensions, tolerances in accuracy and response to imposed influences.

•

American Bureau of Metal Statistics, Yearbook

Published by American Bureau of Metal Statistics, 33 Rector Street, New York. 119 pages. Price, $2.

This compilation of 119 large pages, now in its seventeenth annual issue, presents a collection of useful statistics on production, consumption, imports and exports, prices, etc., non-ferrous metals, applying to the United States and in many instances including world-wide data. The statistics are carried through 1936; comparable figures for earlier years enable changes to be traced without referring to previous issues.

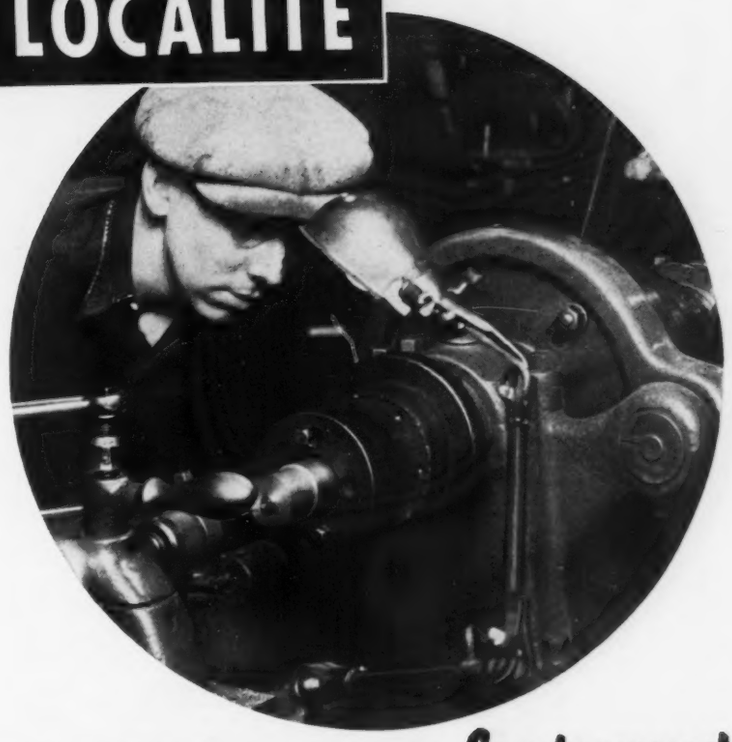
•

Manual of Lathe Operation and Machinist's Tables

Published by Atlas Press Company, Kalamazoo, Mich. 250 pages. Price, $1.

Short sections on coil-winding and commutator resurfacing are the principal electric applications of the lathe here described. However, the utility repair shop or the home hobby workshop will appreciate the simple factual way in which are described the functioning of the lathe and its cutting tools in connection with common metals and their boring, drilling, threading, gear cutting, knurling, tapering and woodturning as well. Tabular data are most practical and advertising is minimized.

Light the Job WITH LOCALITE



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Headquarters for Everything Electrical

PRODUCT INDEX

AIR COMPRESSORS
Allis-Chalmers Mfg. Co. Milwaukee, Wis.

AIR-CONDITIONING EQUIPMENT
General Electric Co., Schenectady, N. Y.
Kelvinator Corp., Detroit, Mich.
Westinghouse E. & M. Co., E. Pittsburgh, Pa.
Worthington Pump & Mchy. Corp., Harrison, N. J.

AMMETER, CLIP-ON
Columbia Elec. Mfg. Co., Cleveland, Ohio
Ferranti Electric, Inc., New York, N. Y.

ANALYSES, REVENUE
Recording & Statistical Corp., New York.

ANCHORS, GUY
Chance Company, Centralia, Mo.
Everstick Anchor Co., Fairfield, Iowa
Hubbard & Co., Pittsburgh, Pa.
Kearney Corp., James R., St. Louis Mo.

ANNUNCIATORS
Bendix Marine Products, Inc., Brooklyn, N. Y.

APPLIANCES, HEATING
General Electric Co., Schenectady, N. Y.
Graybar Electric Co., New York, N. Y.

BATTERIES, STORAGE, ALL APPLICATIONS
Electric Storage Battery Co., Phila., Pa.
Gould Storage Battery Corp., Depew, N. Y.

BLOCKS, LINEMEN'S CABLE STRINGING
Western Block Co., Lockport, N. Y.

BOILERS, STEAM
Babcock & Wilcox Co., New York, N. Y.
Combustion Engineering Co., New York, N. Y.

BRACKETS & WIREHOLDERS, INSULATED
Hubbard & Co., Pittsburgh, Pa.
Line Material Co., South Milwaukee, Wis.
Porcelain Products, Inc., Parkersburg, W. Va.
Utilities Service Co., Allentown, Pa.

BRASS AND BRONZE
Bridgeport Brass Co., Bridgeport, Conn.
Chase Brass & Copper Co., Waterbury, Conn.

BRUSHES, CARBON
National Carbon Co., Inc., Cleveland, Ohio
Ohio Carbon Co., Cleveland, Ohio
Speer Carbon Co., St. Mary's, Pa.

BURNERS, OIL, GAS, PULVERIZED FUEL
Babcock & Wilcox Co., New York, N. Y.
Combustion Engineering Co., New York, N.Y.

BUS BAR SUPPORTS
Burndy Engineering Co., New York, N. Y.
Delta-Star Electric Co., Chicago, Ill.
Electrical Engrs. Eqpt. Co., Melrose Park, Ill.
General Electric Co., Schenectady, N. Y.
Schweitzer & Conrad Inc., Chicago, Ill.

BUS BARS & TUBES
American Brass Co., Waterbury, Conn.
Chase Brass & Copper Co., Waterbury, Conn.

BUSHINGS, APPARATUS
Illinois Electric Porcelain Co., Macomb, Ill.
Imperial Porcelain Works, Trenton, N. J.
Lapp Insulator Co., Le Roy, N. Y.
Locke Insulator Corp., Baltimore, Md.
Ohio Brass Co., Mansfield, Ohio
Porcelain Products, Inc., Parkersburg, W. Va.
Thomas & Sons Co., R. W., Lisbon, Ohio
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

CABLE, ALUMINUM
Aluminum Co. of America, Pittsburgh, Pa.
General Cable Corp., New York, N. Y.

CABLE, NETWORK
Anaconda Wire & Cable Co., New York, N. Y.
American Steel & Wire Co., Chicago, Ill.
Crescent Ins. Wire & Cable Co., Trenton, N. J.
General Cable Corp., New York, N. Y.
Hazard Ins. Wire Works, Wilkes-Barre, Pa.
Okonite Co., Passaic, N. J.
Rockbestos Products Corp., New Haven, Conn.

CABLE, PAPER INSULATED
American Steel & Wire Co., Chicago, Ill.
Anaconda Wire & Cable Co., New York, N. Y.
General Cable Corp., New York, N. Y.
General Electric Co., Schenectady, N. Y.
Kennecott Wire & Cable Co., Phillipsdale, R. I.
Okonite-Callender Cable Co., Passaic, N. J.
Phelps Dodge Copper Products Corp., N. Y.
Roebling's Sons Co., J. A., Trenton, N. J.
Simplex Wire & Cable Co., Boston, Mass.

CABLE, PARKWAY
American Steel & Wire Co., Chicago, Ill.
Anaconda Wire & Cable Co., New York, N. Y.
Crescent Ins. Wire & Cable Co., Trenton, N. J.
General Cable Corp., New York, N. Y.
Kerite Ins. Wire & Cable Co., New York, N. Y.
Okonite Co., Passaic, N. J.
Roebling's Sons Co., J. A., Trenton, N. J.
Simplex Wire & Cable Co., Boston, Mass.

CABLE, SERVICE ENTRANCE
Anaconda Wire & Cable Co., New York, N. Y.
Crescent Ins. Wire & Cable Co., Trenton, N.J.
General Cable Corp., New York, N. Y.
Hazard Ins. Wire Works, Wilkes-Barre, Pa.
Okonite Co., Passaic, N. J.
Phelps Dodge Copper Products Corp., N. Y.
Simplex Wire & Cable Co., Boston, Mass.

CABLE, STEEL STRAND
American Steel & Wire Co., Chicago, Ill.
Indiana Steel & Wire Co., Muncie, Ind.
Roebling's Sons Co., J. A., Trenton, N. J.

CABLE SUBMARINE
American Steel & Wire Co., Chicago, Ill.
Anaconda Wire & Cable Co., New York, N. Y.
General Cable Corp., New York, N. Y.
General Electric Co., Schenectady, N. Y.
Kerite Ins. Wire & Cable Co., New York, N. Y.
Okonite Co., Passaic, N. J.
Phelps Dodge Copper Products Corp., N. Y.
Roebling's Sons Co., J. A., Trenton, N. J.
Simplex Wire & Cable Co., Boston, Mass.

CABLE VARNISHED CAMBRIC
American Steel & Wire Co., Chicago, Ill.
Anaconda Wire & Cable Co., New York, N. Y.
Crescent Ins. Wire & Cable Co., Trenton, N. J.
General Cable Corp., New York, N. Y.
General Electric Co., Schenectady, N. Y.
Kennecott Wire & Cable Co., Phillipsdale, R.I.
Okonite Co., Passaic, N. J.
Roebling's Sons Co., J. A., Trenton, N. J.
Simplex Wire & Cable Co., Boston, Mass.

CABLE ACCESSORIES
Anaconda Wire & Cable Co., New York, N. Y.
G & W Elec. Specialty Co., Chicago, Ill.
General Cable Corp., New York, N. Y.
General Electric Co., Schenectady, N. Y.
Line Material Co., South Milwaukee, Wis.
Metropolitan Device Corp., Brooklyn, N. Y.

CABLE END BELLS
G & W Elec. Specialty Co., Chicago, Ill.
General Electric Co., Schenectady, N. Y.

CABLE GRIPS
Kellems Products, Inc., New York, N. Y.

CAPACITORS
Acme Wire Co., New Haven, Conn.
Cornell-Dubilier Corp., So. Plainfield, N. J.
General Electric Co., Schenectady, N. Y.
National Elec. Condenser Co., New Haven
Products Protection Corp., New Haven, Conn.
Westinghouse E. & M. Co., E. Pittsburgh, Pa.

CASTINGS, BERYLLIUM COPPER
Beryllium Corp. of Pa., Reading, Pa.

CHOKE COILS
American Transformer Co., Newark, N. J.
General Electric Co., Schenectady, N. Y.

CIRCUIT BREAKERS, OIL AND AIR
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

CIRCUIT BREAKERS, OIL AND AIR
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
I-T-E Circuit Breaker Co., Philadelphia, Pa.
Pacific Elec. Mfg. Corp., San Francisco, Cal.
Roller-Smith Co., New York, N. Y.
Square D Company, Detroit, Mich.
Westinghouse E. & M. Co., E. Pittsburgh, Pa.

CIRCUIT BREAKERS, THERMAL
I-T-E Circuit Breaker Co., Philadelphia, Pa.

CLAMPS, GUY
Hubbard & Co., Pittsburgh, Pa.
Kearney Corp., James R., St. Louis, Mo.
Oliver Iron & Steel Corp., Pittsburgh, Pa.

CLAMPS, SERVICE CABLE
Reliable Electric Co., Chicago, Ill.

COILS, MAGNET WIRE WOUND
Acme Wire Co., New Haven, Conn.
Anaconda Wire & Cable Co., New York, N. Y.

COMMUTATOR RESURFACERS
Ideal Commutator Dresser Co., Sycamore, Ill.

CONDENSERS, STEAM
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Ingersoll-Rand Co., New York, N. Y.
Westinghouse E. & M. Co., E. Pittsburgh, Pa.
Worthington Pump & Mchy. Corp., Harrison, N. J.

CONDENSER TUBES
American Brass Co., Waterbury, Conn.
Wolverine Tube Co., Detroit, Mich.

CONDUCTORS, COPPERWELD-COPPER
Anaconda Wire & Cable Co., New York, N. Y.
Copperweld Steel Co., Glassport, Pa.
General Cable Corp., New York, N. Y.
Kennecott Wire & Cable Co., Phillipsdale, R.I.
Phelps Dodge Copper Prods. Corp., New York

CONDUIT, ASBESTOS-CEMENT
Johns-Manville Corp., New York, N. Y.

CONDUIT, FIBRE
Brown Company, Portland, Maine
Fibre Conduit Co., Orangeburg, N. Y.
General Electric Co., Bridgeport, Conn.
Graybar Electric Co., New York, N. Y.
Line Material Co., South Milwaukee, Wis.
Westinghouse Electric Supply Co., New York, N. Y.

CONDUIT, METALLIC
American Brass Co., Waterbury, Conn.
General Electric Co., Bridgeport, Conn.
Graybar Electric Co., New York, N. Y.
National Electric Products Corp., Pittsburgh, Pa.

CONNECTORS, SOLDERLESS
Burndy Engineering Co., New York, N. Y.
Electrical Engrs. Eqpt. Co., Melrose Park, Ill.
Electroline Company, Chicago, Ill.
Fargo Mfg. Co., Poughkeepsie, N. Y.
General Electric Co., Schenectady, N. Y.
Ilsco Copper Tube & Products, Inc., Cincinnati
Kearney Corp., James R., St. Louis, Mo.
Line Material Co., South Milwaukee, Wis.
National Elec. Products Corp., Pittsburgh, Pa.
Penn-Union Electric Corp., Erie, Pa.
Railway & Ind. Engrg. Co., Greensburg, Pa.
Reliable Electric Co., Chicago, Ill.
Sherman Mfg. Co., H. B., Battle Creek, Mich.